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THE LAW AND CHEMISTRY OF FERTILIZERS.

(Continued.)

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THE LAW OF NEW SOUTH WALES.

MENTION has not yet been made of the Fertilizers Act, 1904, of New South Wales, which is unique in its brevity, consisting of four sections only. No. 1 gives the date from which it becomes effective; No. 2 defines the meaning of the words "fertilizer" and "prescribed"; No. 3, which may be quoted in full, provides that "the vendor of any fertilizer shall, on or before the delivery of the fertilizer, furnish to the purchaser a statement as to the nature and quantities of the chemical constituents of such fertilizer in the form to be prescribed, and any person neglecting to furnish such statement or furnishing an incorrect or false statement shall be deemed to be guilty of an offence against this Act, and shall be liable for the first offence to a penalty not exceeding ten pounds, and for any subsequent offence to a penalty not exceeding twenty-five pounds, and in addition shall be liable to pay such costs and expenses as the Court trying the offence may award." No. 4 merely gives the Governor power to make regulations for carrying out the purposes of this Act.

NEW ZEALAND FERTILIZER LAW.

Our Fertilizers Act, 1908, differs in several particulars from other laws. The annual registration of brands, the giving of invoice certifi-

cates, and the routine prescribed for taking official samples are similar to provisions in other laws. The introduction of unit values in the invoice certificate and registration form is novel, but has been of no practical use, as no provision was made for correlating the unit values with the price per ton charged for the fertilizer. The unit value, it may be here explained, is the price at which the vendor values each 1 per cent. in 1 ton of the constituent to which the value is attached; and as 1 per cent. of 1 ton is 2,240 lb. divided by 100, the unit of any constituent is this weight—namely, $22\frac{2}{5}$ lb. The method used for calculating current unit values will be explained later.

In the New Zealand law the taking of official samples on the analysis of which the prosecution of the vendor may be based is restricted to the samples taken by an Inspector under the Act. Every Inspector under the Stock Act, 1908, is deemed to be an Inspector under this Act. When any purchaser desires to have a sample taken with a view to the institution of proceedings against the vendor he must notify an Inspector, and must on demand pay him the fee prescribed by regulations (which in this case is £2 2s.: see *Gazette* No. 13, 15th February, 1906).

If the purchaser desires the Inspector to take an official sample from a consignment delivered at the farm he must notify the Inspector within ten days of delivery of the fertilizer. The Inspector must give the vendor not less than four clear days' notice of his intention to take a sample, and the vendor has the right to see the sample taken and to receive one of the three portions into which it is divided. If the official analyst's certificate—a copy of which is to be supplied both to the purchaser and to the vendor—shows that the fertilizer is not materially at variance with the invoice certificate the vendor is entitled to claim and recover as a debt from the purchaser any reasonable expenses he has been put to in attending the taking of the sample. Power is given to the Department of Agriculture to publish in any manner thought fit the results of any analysis made under this Act, and no person is liable in respect of such publication.

LIMITS OF ERROR.

Most fertilizer laws specify in a schedule the margins within which a fertilizer may vary from the guaranteed composition, due to causes not within the control of the vendor. Such a provision, referred to as the "limits of error" or "limits of deficiency," is necessary to provide for unavoidable errors in sampling or in chemical analysis.

In here tabulating the provisions of the different laws in this respect, in order to get the essential information within manageable compass, the special figures allowed in the United Kingdom for dissolved bones—a fertilizer which is not used in New Zealand—have been omitted. In Canada the provision is made that the deficiency of 0·5 per cent. either of phosphoric acid, nitrogen, or potash is not to be considered evidence of fraudulent intent if the total value of the fertilizer in fertilizing-materials is substantially equivalent to the guaranteed analysis made by the manufacturer or agent. In Victoria the amounts given for phosphoric acid are the total deficiency allowable, but the amount allowable for water-soluble, citrate-soluble, and citrate-

insoluble phosphoric acid is 1 per cent. for each. In South Australia it is provided (sec. 12 (1)) that where the deficiency in acid-soluble phosphate is more than made up by an excess of water-soluble phosphate or citrate-soluble phosphate, or the deficiency in citrate-soluble phosphate is more than made up by an excess of water-soluble phosphate, there shall be no offence. With these qualifications the following summarized tabular statement may be studied.

Country.	Fertilizer.	Nitrogen (N).	Phosphoric Acid (P_2O_5).	Potash (K_2O).
		Per Cent.	Per Cent.	Per Cent.
United Kingdom	Wool, shoddy, hair	1·0	..	..
,,	All fertilizers except dissolved bones and imported guanos	0·3 to 0·5	0·5 to 0·9	0·3 to 2
,,	Imported guano ..	0·5 to 1·0	1·4 to 2·3	0·5
,,	Basic slag ..	..	1·3	..
Canada ..	All fertilizers ..	0·44 (= 0·5% NH_3)	0·5	0·5
Victoria ..	,, ..	0·5	1·5	1·0
South Australia..	,, ..	0·5	0·9	0·5
Western Australia	,, ..	0·5	1·5	0·5
Queensland ..	,, ..	5·0*	7·0*	5·0*

* With the exception of Queensland, all percentages allowed are amounts calculated on the fertilizer. In Queensland the amount is calculated on the total fertilizer constituent present. Where two figures are given the limit allowed varies with the quantity of constituent present.

VALUATION OF FERTILIZERS.

At this stage it will be convenient to introduce an explanation as to the methods of valuing artificial fertilizers by means of unit values already mentioned. Some eighteen years ago Leaflet for Farmers No. 65 was issued by the Department in order to illustrate the methods of calculating unit values, but as the prices of almost all fertilizers have considerably increased since the leaflet was printed it is desirable to bring the matter up to date with the aid of a more modern price-list.

It must be premised that this method of valuing is some attempt by which the market value of fertilizers of varying composition may be arrived at, although the results in a fluctuating market may not necessarily give the true market value, nor is the method necessarily a guide to the agricultural value of any fertilizer to the individual farmer. It is quite possible that if examination by unit values is blindly adhered to the method may be positively misleading to him. The real function of unit values and their application to the fertilizer business is that they enable the farmer to reduce substances containing varying quantities of one or more fertilizing ingredients to a monetary basis. The farmer, being then in possession of a means of translating such terms as phosphoric acid and potash into pounds shillings and pence, is enabled to compare them when the percentages are so similar or the terms so unlike in different fertilizers that comparison would otherwise be difficult. Whether the fertilizers offered him are suitable for his particular land and his crops to be grown there must be determined by him, or some one appointed to advise him, before

he attempts to compare the prices. Artificial fertilizers may contain nitrogen, phosphoric acid, or potash. If he is sure that on his soil either potash, nitrogen, or both, are unnecessary—having had this demonstrated to him by his own or others' experience—it would, of course, be a waste of time to compare the market values of fertilizers containing these two ingredients or either of them.

Chemical analysis of soils, the practical experiences of thousands of farmers, and the importations of fertilizers for the past twenty years all point to phosphates as the most important ingredient of the three for New Zealand soils. These, when examined by chemical analysis, are generally deficient in phosphates, and give a much greater response to phosphates than to nitrogen or potash, only showing injurious results of dressing with phosphates when too great a quantity of the water-soluble superphosphate is used.

Taking, therefore, this ingredient—phosphoric acid, or anhydrous phosphoric acid, or phosphoric anhydride, as it is variously termed—there are three forms in which it may occur in commerce—namely, (1) phosphoric acid soluble in water, (2) phosphoric acid soluble in weak citric acid, and (3) phosphoric acid insoluble in either water or citric acid.

As practically all the phosphoric acid in superphosphate has been made water-soluble, and it is unusual to value the insoluble phosphoric acid in super, it is only necessary to divide the price per ton in shillings by the percentage of soluble phosphoric acid to determine the price of a unit. Thus, with superphosphate containing 16 per cent. soluble phosphoric acid, at £7 4s. per ton, 144s. divided by 16 gives 9s. as the price per unit.

The high-grade Pacific islands phosphates contain about 38 per cent. of total phosphoric acid, 8 per cent. of which is soluble in 1 per cent. citric acid. The price of this ground rock phosphate is about £7 15s. per ton. Deducting from this the value of the 8 per cent. citric-soluble at 9s. per unit, or £3 12s., would leave 30 per cent., or 30 units, of insoluble phosphoric acid, which may be valued at the difference between £7 15s. and £3 12s., or £4 3s., so that each unit will cost only 83s. divided by 30, or 2s. 9d. per unit. It will be observed that in this calculation no difference is made between the price of water-soluble and citric-acid-soluble phosphoric acid. In New Zealand this latter form of phosphoric acid is usually made from superphosphate by the addition of lime, and therefore usually costs more. For the present it will be expedient to treat both forms as equal in value. In 1903 (when Leaflet 65 was issued) the citric-acid-soluble phosphoric acid in Pacific phosphate was not separately valued, hence to compare the present-day price with that of 1903 one must make no distinction, and the value will become £7 15s. divided by 38, or 4s. 1d.

Potash salts can now be obtained for £25 per ton for 50 per cent. dipotassic oxide, which therefore works out at £25 divided by 50, or 10s. per unit.

Insoluble nitrogen in dried blood containing 10 per cent. nitrogen is sold at £20 per ton, which makes the unit value of insoluble nitrogen £20 divided by 10, or £2 per unit. Soluble nitrogen in nitrate of soda containing 15 per cent. nitrogen costs £35 per ton, therefore £35 divided by 15 results in a unit value of £2 7s.

We have now the full data for comparing the unit values given in the 1903 leaflet with those suggested here, as follows:—

	1903.		1921.	
	s.	d.	s.	d.
Water-soluble phosphoric acid (P_2O_5)	6	5	9	0
Water-insoluble phosphoric acid (P_2O_5)	4	4	4	1
Potash (K_2O) ..	7	0	10	0
Insoluble nitrogen (N)	7	6	40	0
Soluble nitrogen (N)	13	0	47	0

When comparing the composition of fertilizers offered by the various manufacturers or firms, in order to translate the terms to a monetary basis it is only necessary to multiply the percentage of each constituent by the unit value suggested for 1921 and to add up the results.

In the majority of districts in New Zealand both the annual rainfall expressed in inches and the number of days with rain are ample. The number of days with rain is a much better guide to the condition of the soil and the best kind of phosphate to apply than is the total number of inches of rain which falls throughout the year. Any district which has an average of 140 to 150 or more days with rain is, the writer considers, suitable for the successful use of finely ground phosphate rock for top-dressing pasture.

It must be remembered that although the greater portion of the phosphoric acid in Nauru or Ocean Island phosphate is insoluble in pure water, rain-water and soil-water are not pure water, and where rain falls on anything like half the days of the year there is ample opportunity for the finely ground insoluble phosphate to be part dissolved and part carried mechanically into the soil, where the particles come within the range of plant-roots and the action of humus, which, with its accompanying nitrogen, always accumulates in grasslands. That such a large proportion as 8 per cent. of the phosphoric acid in this ground Nauru/Ocean rock is found to be soluble by the same empirical test of solubility as is applied to basic slag—the citric-acid test—is a fact not generally known, or we should hear less of the alleged necessity for making it into superphosphate before it will become of use to farmers. The writer would like it to be thoroughly realized by the farming community that Nauru phosphate contains more than one-half the amount of phosphate that is present in basic slag (16 per cent.) in the same state of availability. Therefore in purchasing a ton of Nauru phosphate they can rest assured that they are purchasing the equivalent in immediately available phosphoric acid of half a ton of slag, and in addition the 30 per cent. of phosphoric acid which is more slowly available, and when quite available would be equal to nearly another 2 tons of slag. Then it may be asked when and in what degree the 30 per cent. insoluble phosphate will become available. To which it must be explained that the citric-acid test used to determine the extent of "availability" in a phosphate is purely an empirical one for comparing various phosphates in the laboratory, using a limited volume of weak citric-acid solution and shaking it with the fertilizer for a given time. When the fertilizer is applied to the land, and the conditions much improved by indefinitely increasing and renewing the volume of solution and the time and manner of attack, it is probable that under favourable circumstances, such as an abundance of accumulated humus and a constant supply of soil-moisture, a great part will ultimately become available as food for plants.

[NOTE.—Some difficulty may be encountered in understanding the statement that Nauru phosphate contains 83 per cent. phosphate in

relation to the statement made in this article that it contains a total phosphoric-acid percentage of 38 per cent. The 83 refers to the percentage of tricalcic phosphate it contains; to convert this to phosphoric acid it must be multiplied by 0·458, which makes 38 per cent.]

RAINFALL AND INSOLUBLE FERTILIZERS.

The following rainfall statistics help us to understand why insoluble fertilizers like basic slag are so popular in Britain, why there is a doubt about their efficacy in America, and why there should be no doubt about their use in the moist districts of New Zealand. The New Zealand figures are from a pamphlet "Climate and Meteorology of New Zealand," by the Director of the Weather Bureau, Mr. D. C. Bates, and cover considerable periods of years. The British figures are from the *Journal of the Royal Agricultural Society of England*, Vol. xviii, 1919. Those of the United States are from various sources.

	Inches.	Days.
New Zealand.		
Auckland	43·67	183·3
Rotorua	54·15	142·6
*Hawke's Bay	33·15	102·1
Wellington	48·61	168·0
Moumahaki (north Wellington)	45·76	154·5
*Nelson	37·37	119·0
Hokitika	105·62	152·2
*Lincoln (Canterbury)	25·23	123·0
Dunedin	36·95	159·0
*Queenstown	30·36	89·1
Invercargill	46·59	185·9
Britain.		
North-east counties	25·30	186·0
East counties	25·00	182·0
Midland counties	27·50	179·0
South-east counties	29·10	174·0
North-west counties with North Wales	37·70	195·0
South-west counties with South Wales	41·60	201·0
Channel Islands	32·80	209·0
United States of America.		
Normals for New York and Indiana—		
New York	44·60	117·0
Indiana	41·50	103·0

The districts marked * are among the drier districts of New Zealand. It is to the others not so marked that, if any phosphatic fertilizer is needed, the application of finely ground Nauru/Ocean phosphate would undoubtedly prove successful as a top-dressing for pasture.

From these figures it will be seen how fallacious it is to be guided by the number of inches which fall annually without taking into consideration the number of days on which rain falls, The British climate and soil (generally considered moist) provide conditions pre-eminently adapted for the successful use of basic slag, and yet the total rainfall is the same as for New Zealand's abnormally dry districts of Hawke's Bay, Canterbury, and Queenstown. A glance at the number of days with rain, however, at once makes the position clear. With practically the same rainfall New Zealand's dry districts have a number of rainy days which approaches one hundred, whereas the number for Britain approaches two hundred. The position of Nelson in this respect is worthy of investigation.

LIFE HISTORY OF THE NEW ZEALAND GRASS-GRUB.

DAVID MILLER, F.E.S., Entomologist, Biology Section.

DURING the last two seasons observations have been made by the write on the life-history of the brown-beetle (*Odontria zealandica* White), the larvæ of which, together with those of allied species, are responsible for extensive damage not only to pastures, but also to cereal and root crops, &c. This work is being extended to embrace the life-histories of species other than *O. zealandica* which are known to be injurious.

The adult beetle of *O. zealandica* (Fig. 1) is brown in colour, but with a darker margin to the wing-cases, and is destitute of hair except for brownish hairs along the side of the body, on the head, and across the front edge of the thorax, where they form an erect fringe just behind the head. The surface of the head, thorax, and wing-cases is punctured by minute depressions, while there are several narrow and smooth lines running along the wing-cases, which do not reach quite to the end of the abdomen. The body is rather stout, broader and blunt posteriorly, and measures about $\frac{2}{5}$ in. in length.

The adults are nocturnal in their habits, taking to the wing at dusk, their presence being detected by the loud droning sound which they create when on the wing. After dark they alight and feed upon the foliage of plants, at times causing considerable damage in orchards by defoliating the trees. In this respect the brown-beetle is frequently confused with the bronze-beetle (*Eucolaspis brunneus* Fabr.), which, however, is a quite different species, as may be seen by a comparison of Figs. 1 and 3. The bronze-beetle, also, is diurnal in its habits. During the day the brown-beetle shelters in dense foliage, or burrows beneath the surface of the ground.*

Large swarms of the brown-beetle emerge during October, November, and December, there being only a single brood each year, although odd adults may be found on the wing as late as May and as early as September. Just before the emergence of the main brood in October swarms of another species (*Odontria obscura* Broun) are on the wing. This beetle (Fig. 2) may be distinguished from the brown-beetle by its rather larger size, darker colour, and hairy body.

The female brown-beetle lays her white globular eggs at the base or among the roots of grass, &c., just beneath the surface of the soil, and from these the young grubs hatch to commence their attack upon the plant-roots. Regarding the mating and egg-laying of this insect, Mr. W. W. Smith, of New Plymouth, states that "the first eggs were found on the ninth day (after copulation). They were attached to the base of the small blades of grass, and close to the soil." He found, also, that the grubs hatched from nine to eleven days later.

* It should be borne in mind that the observations here recorded deal only with the main generation of *O. zealandica*, against which control methods must be directed, and not with small irregular or accessory broods which in some localities may be found breeding with, and in different ages of development from, the main generation.

During November a few young grubs may be found at work just beneath the surface of the soil, and by December and January they are extremely abundant. In March a considerable number of the larvæ are half to three-quarters grown, and in April there are very few small ones to be found (see Fig. 7). During May all the larvæ are three-quarters grown, and in cold weather they cease feeding to burrow downward to a depth of 1 ft. or more, if the soil is light. Here they construct smooth-walled earthen cells in which they lie throughout the

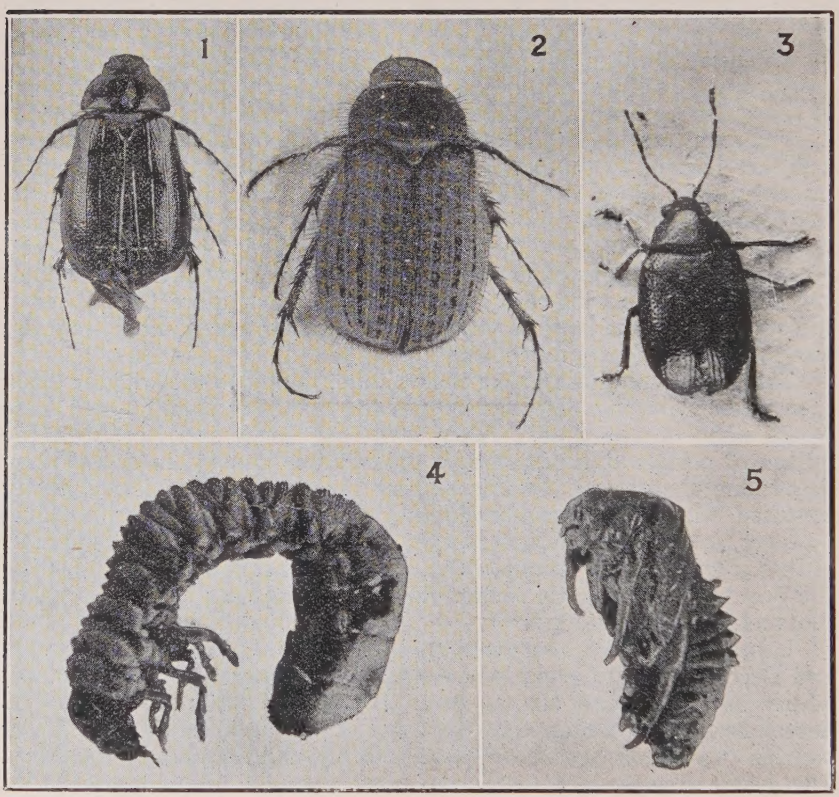


FIG. 1. ADULT OF ODONTRIA ZEALANDICA, × 2½.
FIG. 2. ADULT OF O. OBSCURA, × 2½.
FIG. 3. ADULT OF EUCOLASPIS BRUNNEUS, × 4.
FIG. 4. LARVA OF O. ZEALANDICA, × 4.
FIG. 5. PUPA OF O. ZEALANDICA, × 4. [*E. B. Levy, photo.*

months of June and July and until the approach of warm weather in August, when they work to the surface and commence to feed again upon the plant-roots. In some parts of New Zealand where the winter months are mild the grass-grubs will be found feeding most of the time, but during cold spells will burrow downwards into the soil. Exceptionally warm weather in the colder districts will bring the hibernating larvæ to the surface.

The grass-grub (Fig. 4) is creamy-white in colour, with a brownish head, and lies in the ground doubled up in the form of a letter U, the enlarged and smooth apex of the abdomen being thus brought just below the head. The surface of the body is wrinkled with the exception of the apex; the latter may be discoloured according to the contents of the gut. The grub passes a large quantity of earth mixed with food through its body, and when present in large numbers the grubs thoroughly pulverize the soil. In soil containing no plant-roots and very little nourishment the larvæ will live for many weeks passing and repassing the soil through the alimentary system.

Throughout August the larvæ become full-grown, and early in September several again leave off feeding and descend to varying depths of from 1 ft. or more according to the soil. Earthen cells are again formed, within which the larva transforms to a creamy-white pupa

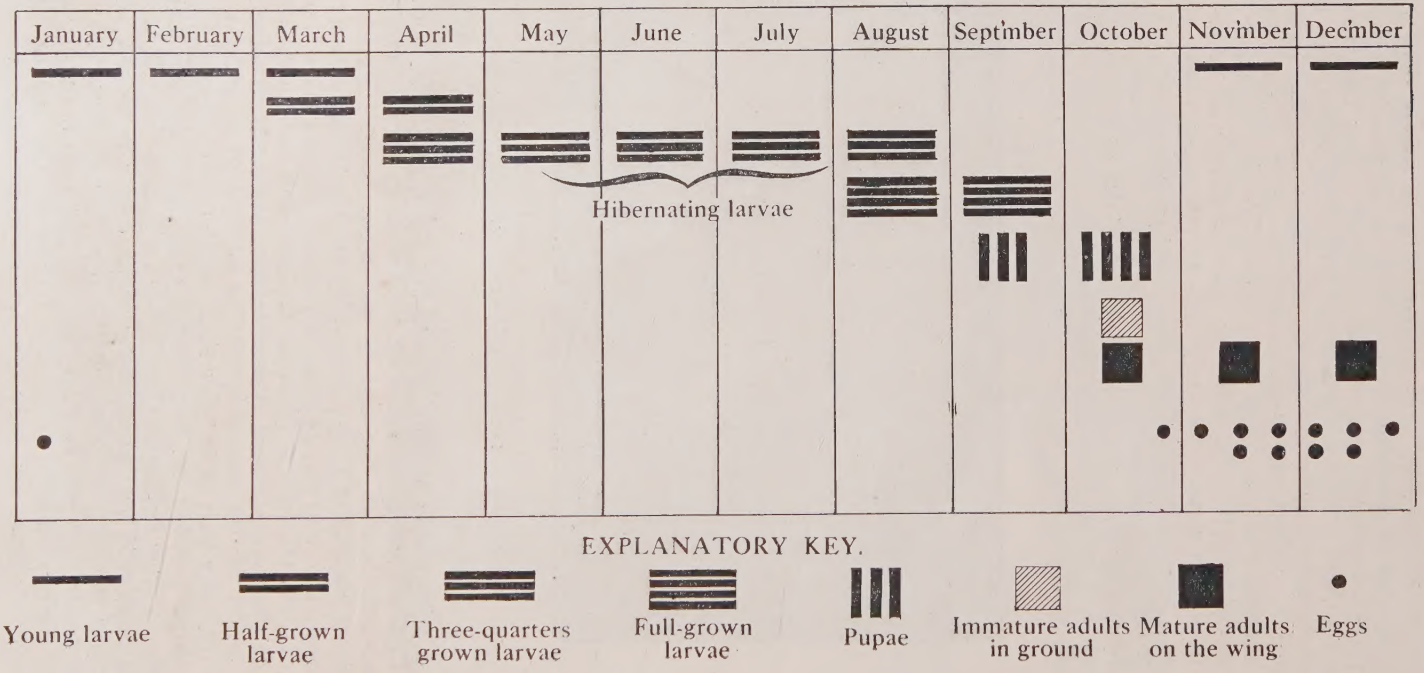
FIG. 6. LARVÆ OF ODONTRIA ZEALANDICA TURNED UP TO THE SURFACE, AND IMMEDIATELY BURROWING INTO THE SOIL.

[*E. B. Levy, photo.*

(Fig. 5), with the sheaths of the adult appendages clearly showing. At this stage the crumpled skin cast by the larva during transformation remains attached to the end of the pupa body. By the end of September practically all the larvæ have left the surface and constructed the pupal cells, and by the second week of October have transformed to pupæ. As the time approaches for the adults to emerge, the wing-cases of the pupæ become brownish-pink, and from this the approximate period for the emergence of the adults can be gauged.

In the early part of October adult beetles have emerged from many of the pupæ first formed. On emerging the beetles are soft and whitish in colour. They remain in the soil for a few days until the integument has hardened and the characteristic brown colour developed, when they work their way to the surface and take to the wing at dusk. During early October there are very few larvæ, a great many pupæ, and many freshly emerged adults. By the middle of the month there are practically no larvæ and very few pupæ, but an abundance of freshly

FIG. 7. DIAGRAM SHOWING THE SEASONAL CHANGES IN THE LIFE-CYCLE OF THE MAIN GENERATION OF ODONTRIA ZEALANDICA.



emerged and fully developed adults, the latter being also on the wing. At the end of the month practically all the adults have left the pupæ, and most of them are fully developed. During November the large flights of the adults occur, but the numbers lessen in December, only an occasional beetle being found later.

A review of the life-cycle of *O. zealandica* (Fig. 7) shows that larvæ are in the ground practically the whole year—except in some cases for a brief space at the end of October and beginning of November—between the main period of pupation and the hatching of the first eggs. The periods of activity are mainly from December to well into May, and again in August and part of October, the greatest injury being caused by the three-quarter-grown forms during March, April, and May, up to the time they burrow downwards to hibernate.

The foregoing observations were carried out for the most part at Weraroa, in the Wellington District, and a certain amount of variation in the life-changes is to be expected under different climatic conditions in other parts of the Dominion.

KIKUYU-GRASS ON NORTHERN GUM LANDS.

KIKUYU-GRASS (*Pennisetum clandestinum*), roots of which were imported from Rhodesia, has given very promising results both at the Albany and Puwera Experimental Areas (northern gum lands). On these areas sufficient roots were available during the year to plant fairly large plots. The grass was grown without any added fertilizer, and has flourished even in the hot, dry autumn. It withstands the cold also. At Puwera, where the thermometer registered 30° F. on three separate occasions, the grass did not "burn off." At Albany, however, the first severe frost turned it white, and it ceased to grow afterwards until the spring. It has now been under trial for two years. Lotus major and Lotus hispidus (angustissimus) grew up as volunteers among the kikuyu-grass, which was a decided advantage, because the presence of the legumes assisted the growth of the grass and brought about an improvement in the feeding-value of the pasture. Horses and sheep taken off a pasture of mixed grasses and clovers and turned on to the plots ate the kikuyu-grass readily, showing that as regards palatability it gave satisfaction. In Africa it is thought highly of, and in New South Wales, where trials have been in progress for some years on poor lands, it has been demonstrated that stock like it, particularly dairy cows, and they milk well on it. It should be a useful addition as a special pasture or in a mixture in districts where the summer is long, as in North Auckland. A number of farmers received roots of the grass for trial purposes; only two reported, but both favourably. One, who had a small plot, found during the dry autumn, when the pasture on the clay lands of his place was burnt up, that a cow turned in on it ate it readily.

This evidence, though somewhat insignificant, is nevertheless encouraging for further and more extensive tests. Trials are in hand for the coming season in which white clover and other pasture elements are being combined with kikuyu to try and make a mixed pasture. The grass has not yet set seed with us, nor has it done so in Australia. However, the first introduction into Australia was by means of seed. If a supply of seed were available from Africa, where inquiries are now being made, it would be a distinct advantage from the economic standpoint when laying down area. It may be mentioned that the scientific name of kikuyu has been wrongly given as *Pennisetum longistylum*, but it is now described as *P. clandestinum*.

—T. H. Patterson, Instructor in Agriculture, Auckland.

COMMERCIAL POTATO-GROWING.

(Continued.)

H. E. McGOWAN, Willowbridge, South Canterbury.

MANURING.

On average soils manure is very necessary for potato-growing, and will help the yield considerably. Without some knowledge of special localities and soils it is, of course, not feasible to prescribe mixtures and quantities of manures. What would suit a light sandy soil, for instance, would be comparatively useless for a cold clay or ironstone soil, and so on. My advice to growers is to have small experimental plots of their own and try various mixtures; such work will be found most interesting as well as useful. My own practice has been to run experimental plots 1 chain in length, which makes the per-acre calculations easier; also to mark each row with a good strong peg, painted white, on which particulars can be written as the crop grows.

Willowbridge soil is a rich sandy loam, probably deposited by floods in past ages, and ideal for potato-growing, crops up to 20 and 25 tons per acre having been grown without manure. Manuring this soil is quite superfluous if it is in good heart—that is, if the potato crop follows clover, old pasture, or peas or beans. After a succession of exhausting crops, however, it responds to manuring, as will be seen by the following experiment made in 1912 in a field which had previously been cropped twice with wheat and once with oats (without manure). The season was a medium one for potato-growing. All figures are per acre.

Plot 1 (check): No manure; yield, 12 tons 10 cwt. Plot 2: Superphosphate 1 cwt., bones 1 cwt., potash 1 cwt.; cost, £1 6s.; yield, 13 tons 14 cwt. Plot 3: Super 1 cwt., bones 1 cwt.; 11s. 6d.; 13 tons. Plot 4: Super 1 cwt., bones 1 cwt., ammonia 1 cwt.; £1 7s. 6d.; 13 tons 5 cwt. Plot 5: Bones 2 cwt., potash ¾ cwt., ammonia ½ cwt.; £1 11s. 6d.; 15 tons. Plot 6: Super 2 cwt., potash ¾ cwt., ammonia ½ cwt.; £1 8s.; 16 tons 16 cwt. Plot 7: Super 1½ cwt., bones 1½ cwt., potash 1 cwt., ammonia ¾ cwt.; £2 4s. 3d.; 13 tons 14 cwt. It will be noted that plot 6 gave the best result, a yield of 4 tons 6 cwt. in excess of that of the check plot, at a cost of £1 8s. The mixture (No. 6) is undoubtedly one of the best balanced manurings that can be used, confirmation of this being afforded by the records of many American experiments which have come under my notice, and it may probably be recommended for a wide range of soils.

Ordinary farmyard manure ploughed in before planting is very good for light land, and responds well. Manuring in general will improve the yield, but the quality of the potatoes is usually affected, the percentage of starch being less than in crops grown without manure. Manured crops are also more susceptible to blights.

As regards the method of applying manure, if a machine planter is used a manure-sower is attached, which deposits the fertilizer into the open drill and mixes it with the soil. If planting is done in the open drill or furrows the manure is distributed by hand.

CULTIVATION AFTER PLANTING.

It will be realized that the straighter the potatoes are drilled and the more correctly the rows are distanced the easier the after-cultivation will be. If the machine has been used, I would suggest a light moulding-up of the rows a fortnight or three weeks after planting; the machine planter always moulds up slightly, and the rows are easily seen. Then just before the potatoes come through give a harrowing with light harrows. There is a special set made for this work called the "saddleback," but ordinary grass-seed harrows will do. As soon as the plants are showing slightly, mould up again. If the planting has been done by hand after the mould-plough, harrow the drills down in about a fortnight and continue as described above. If planting has been on the flat behind an ordinary plough, give a stroke of the harrows

MOULDING UP POTATO CROP WITH A DOUBLE MOULDER.

Up to 10 acres a day can be done with this machine.

just before the potatoes are up, and then mould slightly as soon as the rows can be seen, harrowing down almost immediately afterwards. Cultivation done on these methods will destroy most of the young weed-seedlings, and will save the grower an immense amount of hand-work.

Cultivation from then on must be governed by the amount of weeds present. Keep the soil well and deeply cultivated between the drills until the potatoes commence to flower, spring-tine cultivators being the best for this work. Great care should be taken not to get too close to the plants with the cultivator-tines, for every potato root or rhizome cut off or damaged means the loss of a tuber. As soon as the potatoes commence flowering give the final moulding. This should be good and deep, with the soil well banked up to the haulms, otherwise

there will be many potatoes greened by the sun; also, if the potato-moth is in evidence the tubers close to the surface will be attacked. If any further weeds appear they should be hand-pulled, remembering the old proverb, "One year's seeding, seven years' weeding," and also that weeds are a difficulty when digging. Moreover, nothing looks better than a properly planted, well-kept potato-field in flower.

DISEASES AND INSECT PESTS.

Every potato-grower should be reasonably conversant with the various fungous diseases and insect pests of the crop, and should know how to deal with them. In New Zealand, as in other countries, the aggregate loss through these blights is very large, but could be avoided to a considerable extent if the grower would only take the trouble to

SPRAYING WITH BURGUNDY MIXTURE: NOTE THE FINE MISTY SPRAY.

This photo and the preceding one were taken at Willowbridge.

carry out spraying and other preventive measures. I now purpose dealing briefly with those potato troubles which are more or less prevalent in this country.

Black-leg or Black-stem (Bacillus phytophthorus).

This is a bacterial disease of the stems and tubers of the potato which affects the crops in New Zealand to a larger degree than most growers are aware—indeed, I feel safe in saying that 75 per cent. of our growers do not know what black-leg is, and often wonder why so many hills in their crops are so poor. The first sign of the disease appears when the plants are about 6 in. above ground. Plants will then be noticed here and there beginning to discolour, first turning a slightly yellow tinge, with leaves pinched and inclined to stick up, while later

the yellow foliage is inclined to colour purple at the tips. From then on the plant either dies or remains dwarfed. The presence of black-leg may be easily detected by pulling up a plant: if the end of the stem is black one may be sure of the disease. Possibly small tubers will be found on the root; and if about ½ in. of the stem end of these is cut off a black or brown ring will be found within the tuber and near the skin. These diseased tubers carry the disease from season to season, and it will be readily seen how very necessary it is that they should not be planted for seed.

When black-leg appears I would strongly advise digging up diseased hills and destroying both tops and tubers. If imported seed or another grower's seed is being planted I would suggest cutting about ½ in. off the stem end of each seed-potato and throwing out any showing the brown or discoloured ring. These methods will be the only means of keeping the crop free from the disease. Spraying for black-stem is useless. It may be as well to mention here that the "stem end" of a potato is the end that is attached or has been attached to the root when growing; the "rose end" is the opposite end with all or most of the eyes.

Irish Blight or Late Blight (Phytophthora infestans).

This, the most dreaded potato-disease, usually appears late in the season after the plants have flowered and are forming tubers—in Canterbury and Otago at the end of January or in February, and in the North Island earlier. The climatic conditions have a lot to do with the virulence of the attack. It is favoured by moist muggy weather, with a little wind to carry and spread the spores; in hot, dry weather there is little fear of infection. The first appearance of Irish blight in a crop will be noticed on the leaves, small light-brown spots showing on the under-parts. If the weather is moist and warm the spots spread quickly, and the whole field is soon affected. The blight always spreads with the wind, and the spots quickly merge into one another. When a crop is stricken quickly the rotten musty smell created is most disagreeable; in fact, this smell is easily picked up by an experienced grower almost as soon as the spots appear on the leaves. The blight quickly travels through the system of the plant down to the tubers; spores also fall from the leaves on to the ground, and are often carried by rain through the soil to the tubers near the surface; hence the benefit of hilling or moulding up well. It is most disheartening work harvesting a blight-stricken crop; even with the utmost care a number of blighted tubers are put into the sacks or pits and thus contaminate the potatoes in bulk. No variety of potato is absolutely immune, although some varieties are more blight-resistant than others; and it will be found that a variety containing a high percentage of starch will be much more resistant than one containing a low percentage.

As regards preventive measures, when selecting seed make sure, if possible, that it does not come from a locality or crop that has been affected by blight. Pick over the seed before planting, throwing out any tubers showing blight. If it is necessary to buy seed, do so from a reliable grower; a few shillings extra per hundredweight is a trifle if one is getting good clean seed, and it is folly to plant diseased seed. I am not a believer in dipping or immersing the seed in the various

solutions now on the market before planting. The resting mycelium of the fungus is more than skin-deep, and a solution strong enough to get at it thoroughly would undoubtedly injure, if not kill, the eyes of the seed so treated. The only real preventive is careful spraying with a correctly made solution of bordeaux or burgundy mixture at the right period.

For any area of over 4 or 5 acres a power sprayer is required—that is, a horse-drawn machine which will spray four or five rows at the same time. The machine must spray both upwards and downwards. Potato-tops naturally hang in a drooping position, and the spray must reach the under-part of the leaves. Personally, I prefer the double nozzles on the lower pipes set at a fair angle towards each row. The spray should be as fine as possible, a pressure of about 150 lb. being required for this. It is impossible to give definite dates for spraying to suit each district, but by commencing when the potatoes start flowering one will not be far out; it is better to be too early than too late. After commencing, continue spraying every fortnight until the crop ripens.

I am well aware that many consider spraying does not pay for the labour and trouble, but if only one crop is saved by the process every five years it is surely a good proposition. In this connection I may cite an experiment conducted by me at my own farm on a 20-acre area of Up-to-Date potatoes. In this case, through heavy rains, we could not make a start with the sprayer until indications of blight appeared among the potatoes. We sprayed with bordeaux three times—first with a 4–4–40 mixture, a fortnight later at 5–5–40, and again about three weeks later at 6–6–40. Five rows were left unsprayed in the centre of the field. The season was not a favourable one for heavy crops owing to drought in the early months and heavy late rains, but the following was the result at digging: The check or unsprayed five rows, which had gone quite blighted and withered, yielded 2 tons 10 cwt. per acre, mostly seed-size and badly blighted; the remaining portion of the field, which had been sprayed three times, yielded 6 tons 15 cwt. per acre, while the quality of the potatoes was good and very few were blighted.

When properly mixed and applied bordeaux mixture completely covers the leaves and stems with a thin film which, although harmless to the plant, destroys any fungous spores which may happen to alight and germinate. The spray also hardens or toughens the leaves and stems, making them less susceptible to early frost. Further, it prolongs the life of the plant three or four weeks. Experienced growers know that the tubers make the greater part of their growth towards the end of the season, so by prolonging the life of the plant the smaller or immature tubers are given an opportunity to grow into large potatoes, with a correspondingly increased yield of better quality.

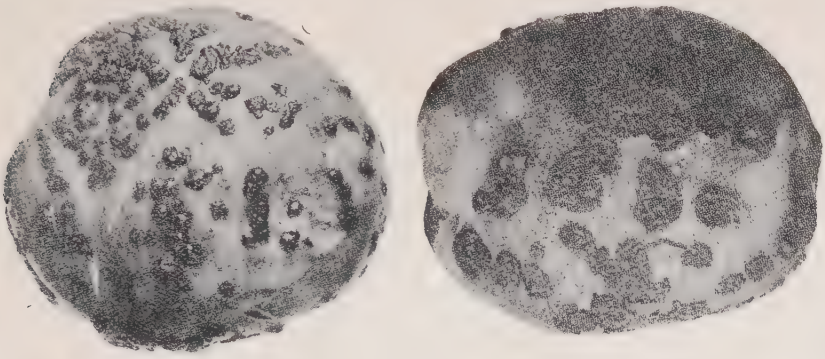
Ordinary Potato-scab (Actinomyces scabies).

This scab is one of the most puzzling diseases with which the potato-grower has to contend, opinions being very conflicting as to its cause. It always appears to be more prevalent when too much farmyard manure, lime, or cinder ashes are used. The tubers affected

are marked skin-deep with rough brown marks, generally about $\frac{1}{8}$ in. across, though in bad cases I have seen the whole surface of the tuber a mass of scab. Scabby seed in general should not be used, and where an area of land is affected, potatoes should not be planted again for five or six years. Affected seed of any particular variety which one may wish to plant should be soaked for two hours in formalin, and dried before planting. This will help to kill the infection. Tubers affected with scab are quite good for table use—in fact, they are often more floury than others.

*Powdery Scab (Spongospora subterranea).**

This disease was brought into prominence last season through the Australian Commonwealth Government prohibiting the importation of New Zealand potatoes owing to signs of powdery scab having been found on potatoes imported from the Dominion the previous year. The occurrence of the disease in this country is comparatively slight,



ON LEFT, POTATO AFFECTED WITH POWDERY SCAB. ON RIGHT, TUBER WITH ORDINARY SCAB.

The pimples or pustules of powdery scab are shown in their early stage before rupturing.

and any harmful effect it may have on the crops very small. As a matter of fact, powdery scab is so little known here that I doubt if 1 per cent. of our growers would recognize it if it was pointed out to them. It must not be confused with the ordinary scab; the latter is blister-like, while powdery scab, in its early stage, more resembles pimples with light-brown or green heads. If the top is scraped from one of these pimples it will be found to contain a brown or greenish powder. The pimples subsequently rupture, leaving the powdery matter exposed. Affected tubers are quite good for food.

For prevention and control disease-affected seed should not be planted, seed from an affected district being avoided. Do not plant the same ground two years in succession. If doubtful about the seed, it should be dipped in corrosive sublimate solution or formalin.

* For further information on this subject generally see article "Powdery Scab in Potatoes," by A. H. Cockayne, in *Journal* for October, 1920.

Bacteriosis or Milky Eye (Bacillus solanacearum).

This bacterial disease, though occurring in certain parts of New Zealand, is fortunately not very widespread. It is only seen when there is a good deal of damp and muggy weather, and its presence is indicated by the sudden drooping or withering of the foliage or haulms, followed by discoloration and collapse. If the stems of the haulms are cut open near the butt end, where the disease usually strikes the plant, brown streaks will be seen. Later the affected part develops into a soft slimy rot, and after a plant becomes infected it is only a matter of a few days before it collapses. The disease runs downward to the tubers: these become soft when affected, and if pressure is used, drops of yellow liquid will ooze from the eyes; hence the name "milky eye." The disease is carried from season to season by affected tubers or in the soil.

All tubers and tops of affected plants should be burnt as soon as the disease is noticed. Thorough and persistent spraying with bordeaux and paris green is a preventive, though not completely effective. The disease is carried from hill to hill by insects, and the spraying will help to kill these.

Rhizoctonia or Russet Scab (Rhizoctonia solani).

This is a disease which is very common in New Zealand; in fact, there are very few crops which are not affected more or less, though no serious destructive results have so far been noticed here. When digging, small hard, dark, or brown shell-like spots on the skin of the tubers will often be noticed. These are really the sclerotia or resting bodies of the rhizoctonia fungus. It is said that rhizoctonia may strangle the growth of the tubers. In parts of America in 1900 the disease did considerable damage to the crops; promising plants when dug were found to have so few tubers that the crop was not worth digging. The fungus thrives in damp or badly drained soils. A good dressing of lime on the soil before planting would be beneficial. If the seed is affected I would suggest dipping in formalin solution.

Potato Tuber-moth or Grub (Lita solanella).

As a rule this pest appears only in very dry seasons. Its first appearance in the potato crop is heralded by myriads of small light-grey moths; as the grower walks through the crop and disturbs these insects they fly around in thousands. When this occurs no time must be lost in getting the sprayer to work. Spray with the ordinary bordeaux or burgundy mixture, to which must be added 1 lb. paris green to every 50 gallons of spraying-solution. The moth lays its eggs on the potato-leaves, in the forks of the branches of the plant, and in the eyes of any tubers which may be showing above ground. The eggs usually take about a fortnight to hatch, and this first batch of grubs gets to work very quickly, boring into all tubers near the surface; indeed, if the attack is very bad it is surprising how deeply into the soil they will penetrate in search of fresh tubers.

The only remedy is careful spraying as mentioned; the paris green added to the bordeaux mixture kills the moths, also the eggs. Spray weekly until certain that the pest is controlled. Do not leave

affected tubers on the surface of the ground, as they will act as excellent breeding-places for the moth; either burn or bury them immediately.

Preparation of Spraying-mixtures.

The formula of bordeaux mixture (4–4–40 solution) is copper sulphate (bluestone) 4 lb., lime 4 lb., water 40 gallons. The necessary apparatus for mixing and holding average quantities consists of a wooden tub holding 100 gallons, a 20-gallon tub or barrel, two 40-gallon barrels, and a mixer (a piece of $1\frac{1}{2}$ in. board, 1 ft. 6 in. by 6 in., with a handle in centre).

The following are practical directions: Fill the 20-gallon barrel with water; weigh out 4 lb. of bluestone, place it in a piece of thin sacking or scrim, and suspend in the water. Bluestone dissolves readily if suspended in water, but will not dissolve so readily if put at the bottom of the barrel. The lime should be freshly burnt. Slake 4 lb. with a small quantity of water; as soon as slaked, empty into one of the 40-gallon casks and make up to 20 gallons; or 8 lb. of lime can be slaked and made up to 40 gallons—enough for two mixings. If desired the lime could, of course, be slaked in bulk (which would certainly be more convenient), and quantities then weighed out as required. The mixture is made by pouring the lime and bluestone solutions simultaneously into a third vessel. These proportions provide ample lime to more than neutralize all the copper sulphate, provided the lime is of good quality, newly burnt, and all dissolved. In order to ascertain when the copper sulphate is neutralized, the quickest test, and a reliable one, is to place a bright steel knife-blade into the solution for a few minutes: if it shows a coppery stain the mixture is not neutralized and more lime-water must be added. Another sure test is with ferrocyanide of potassium. Drop a few drops of this into the mixture, and if it is neutral the drops will not discolour. If not neutral the drops will spread and show a copper colour; if so, add more lime-water until the mixture is neutralized. Litmus paper may also be used; this can be had, with directions for use, from any drug store. Strain the solution through cheesecloth into the sprayer, and stir well at same time. By using the 100-gallon tub that quantity of solution can be made up ready for the sprayer. The mixture should not be prepared more than three or four hours before spraying. The 20-gallon cask should be kept for the bluestone solution, one 40-gallon cask for the lime-water, and the other for a supply of fresh water. A water-cart will also be required unless there is a supply of water in the field.

Burgundy mixture is practically the same as bordeaux, but washing-soda is used instead of lime for making the solution. I would suggest 6 lb. of soda instead of 4 lb. for neutralizing, or a 4–6–40 formula. Burgundy mixture responds to the same tests as bordeaux.

The addition generally of 6 oz. of paris green or 1 lb. of arsenate of lead to each 40 gallons of bordeaux or burgundy mixture may be recommended for the purpose of killing green-spider and other leaf-pests. It also helps to check the potato-moth.

Rabbit Districts.—The constituting of four new rabbit districts was gazetted on 29th September—namely, Roxburgh East and Mount Benger (Otago), Lochiel (Southland), and Whitehall (Auckland).

PROGRESS OF THE NAURU AND OCEAN ISLAND PHOSPHATE INDUSTRY.

ALBERT F. ELLIS, New Zealand Phosphate Commissioner.

THE first year's work since the purchase by the Governments of the United Kingdom, Australia, and New Zealand of the phosphate business on Nauru and Ocean Islands terminated on 30th June last, by which date a total of 364,000 tons phosphate had been shipped, constituting a record year's work for the two islands. On the whole, fine weather favoured the operations, and the only set-back which Nauru had to contend with was a severe epidemic of pneumonic influenza, which caused regrettable mortality among the coloured people on the island. The Europeans, under the direction of the medical

PHOSPHATE WORKINGS AT NAURU, SHOWING CABLEWAY.

department, speedily organized for relief purposes, and the epidemic was practically stamped out before the extra medical assistance from Australia arrived. Fortunately, Ocean Island escaped the outbreak, and was able to cope with the shipping until Nauru regained fairly normal conditions.

The first six months of this year (1921) have given a satisfactory total of 203,000 tons, and if the fertilizer-market can take the full output it is hoped that a record year's work will be done. In a business of this nature a big output is of vital importance in bringing down the cost of production, otherwise the inevitably heavy overhead expenses are liable to swamp the results.

Up to the present Australian consumers have benefited most by the Nauru/Ocean purchase: they took 265,000 tons of phosphate

during the first year. This quantity works up into over 500,000 tons of superphosphate, and, as an average dressing of 60 lb. to 80 lb. of super per acre is used, the figures are significant. It is characteristic of the fertilizer trade in Australia that they will have only the best article; low-grade phosphates from other sources have no sale there. The demand for Nauru/Ocean phosphate in New Zealand is undoubtedly increasing, but so far it falls short of the 16 per cent. for which our Prime Minister secured the option under the Nauru Island agreement. It is probable that next year will give a better showing in this respect.

Satisfactory progress has been made at improving the rate of shipping at Nauru lately, and recently the s.s. "Kauri" loaded a cargo of 4,200 tons for New Zealand, spending only two days and a half at the island. When it is considered that the phosphate has to be taken off in lighters carrying from $2\frac{1}{2}$ to $3\frac{1}{2}$ tons it will be realized that shipping operations constitute a busy scene there. Every effort is made to give vessels quick despatch, as this is an important factor

LOADING TRUCKS WITH PHOSPHATE AT NAURU.

towards securing low freights; the Nauru/Ocean industry is as much a shipping proposition as a mining one.

A noticeable feature at Ocean Island is the way the phosphate workings in the central tableland have been developing lately. In places quarrying is done to a depth of 60 ft. without reaching the bottom of the deposit. The quality there is of the almost phenomenal richness of 88 per cent. phosphate of lime, and so uniform that cargoes are shipped of that percentage. It should perhaps be explained that when the writer has alluded to the quality of Nauru/Ocean phosphate being 85 to 88 per cent. phosphate of lime the percentage is calculated on the dry basis, which means that the moisture is deducted, as is customary in the wholesale trade. The moisture averages 3 per cent., so that when quality is stated on the normal basis, as is the custom in

the retail trade, the percentage of phosphate of lime would be 2 or 3 per cent. lower. This explanation is given because the user of Nauru/Ocean phosphate, when buying it on a guarantee of 80 per cent., may think that foreign matter has been mixed in. If samples were submitted to analysis, however, it would be found to run 82 to 85 per cent. on the normal basis, equal to 85 to 88 per cent. on the dry.

An event of historical interest at Nauru recently was the arrival of the first Australian Administrator there, General Griffiths. Under the terms of the Nauru Island agreement the island is administered by Australia, the United Kingdom, and New Zealand successively, in five-yearly periods. General Griffiths, who was Chief of Staff to General Sir William Birdwood during the war, has already won the respect and confidence of the island community. The Nauru Natives express their pleasure emphatically at being under the British instead of the German flag.

The Ocean Island Natives were quite excited recently over the discovery of a fine large cave containing plenty of fresh water. The entrance to this was opened up during our quarrying operations. The Natives say that the new cave contains a much better supply than any of theirs, and in future it should prove of great value to them. As related in the writer's general article published in the *Journal* for December last, the past history of Ocean Island is tragic with regard to the water-supply.

STRYCHNINE POISONING: CAUTION NEEDED.

A REGRETTABLE case of poisoning has recently been investigated by the Department's Chemist (Mr. B. C. Aston). A farmer lost eighty pigs, the symptoms being suggestive of poisoning. The case was investigated in the field by Mr. E. E. Elphick, Veterinarian, who submitted specimens of the stomach of a pig and of a dog which was also poisoned. In the stomach of the pig 0·258 gramme of strychnine was found. Wynter-Blyth, in "Poisons," quotes Christison's researches to the effect that 0·20 gramme (about 3 grains) is fatal to swine. This pig had therefore evidently been poisoned by strychnine. From the stomach of the dog was isolated 7 milligrams of strychnine. The baits were carrots and potatoes containing a core of pure crystallized strychnine. There is no evidence what bait the dog took. A child was observed to eat a piece of carrot bait, but apparently did not reach the poison.

The whole case points strongly to the necessity for caution when laying baits poisoned with strychnine. It is a criminal offence to lay poison on a road or within a certain distance of it. Strychnine is one of the most poisonous compounds known, ½ grain to 2 grains being the lethal dose for adult humans. It is extremely desirable that some brilliantly coloured substance should be mixed with all strychnine used for poisoning purposes, as it is attractive-looking in the pure state and might attract children to taste it. Moreover, it might be mistaken for some other white powder used in culinary operations, and on the farm it is notorious how loosely such substances are kept, being often in close proximity to foodstuffs.

Hawthorn and Fireblight.—The Avondale Road Board and the Newmarket Borough Council (Auckland) have declared hawthorn to be a noxious weed in the districts under their jurisdiction.

BLACK-SPOT OF APPLE AND PEAR.

FINDING OF THE WINTER-SPORE FORM OF THE ORGANISMS IN NEW ZEALAND.

[The two articles published in the following pages record and discuss an interesting mycological discovery of considerable practical bearing on our orchard industry, in relation to the very troublesome black-spot disease. It will be noted that by a coincidence the definite results were arrived at very closely in point of date by the two scientific workers concerned. On this the occasion of her first contribution to the *Journal* Dr. Curtis may be introduced to our readers as the mycologist to the Cawthron Institute, where she is evidently finding good scope for her special branch of scientific research.—EDITOR.]

THE SIGNIFICANCE OF THE DEVELOPMENT IN NEW ZEALAND OF THE PERITHECIA OF THE APPLE AND PEAR BLACK-SPOT ORGANISMS (*VENTURIA INAEQUALIS* AND *VENTURIA PIRINA* RESPECTIVELY).*

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DURING the many years that have elapsed since the introduction into New Zealand of the fungi causing black-spot on pear and apple—which until now have been recognized in this country only in their conidial, summer form—the question whether the winter, ascigerous form developed in other parts of the world occurs here also has remained until September of this year an unsolved problem. Yet the determination of the presence or absence of the ascigerous stage is of importance both to the scientist and to the orchardist. To the former it is of interest in that definite information on the subject means that one more fact can play its part in a controversy at present exercising a section of the mycologists of England and of the United States of America. The point at issue is whether in those members of the Ascomycetes which, under the climatic conditions of parts of Europe and North America, produce conidia in summer and ascospores during or at the end of winter, there may not take place, when the organisms occur in regions in which the winter is mild, an extension of the period of conidial production correlated with the elimination of the ascigerous

* The phase of the black-spot fungi hitherto recognized in New Zealand produces in summer the type of spore known as the conidium. The names of this stage are *Fusicladium dendriticum* (the fungus on the apple) and *Fusicladium pirinum* (the fungus on the pear). After the fall of the leaf in both cases the fungus spreads throughout the dead tissues of the latter, and toward spring there develop in the leaves flask-shaped bodies whose base lies in the tissue of the leaf, and whose neck at maturity opens on to the free surface (usually the lower) of the leaf. These flask-shaped bodies are the perithecia, and within them, in long cells (asci), is developed a second type of spore, which is distinguished from spores that do not arise in asci by the name of ascospore. The ascospores infect young portions of the host plant in spring, and the yearly cycle of development is then completed by a recurrence of the production of conidia.

stage. As the fungi causing black-spot belong to the Ascomycetes, and as the climate of the mid and northern parts of New Zealand in which apples and pears are cultivated may be considered mild, the determination of the life-cycle of these organisms in this country furnishes an acceptable link in the chain of evidence concerning their development under climatic conditions which, compared with those of their places of origin, are somewhat abnormal. There is without doubt an extended period of conidial production in New Zealand. Apples bearing black-spot areas were watched during the past winter as they lay on the ground in one orchard of this (Nelson) district. Viable conidia were produced on them at irregular intervals throughout the winter, and this development continued until after the maturation of the ascigerous form—that is, until the time when the conidial phase normally recurs. Thus, although the production of conidia during this period was irregular and confined to the fungus on the fruit alone, yet actually conidia were produced all the year round. It would seem, therefore, that if in any country conditions are to be found favouring the omission of the ascigerous stage without detriment to the maintenance of the fungus such conditions exist in New Zealand, and that therefore the absence of the ascigerous stage might reasonably be expected in this country. How little this expectation is justified, however, is shown by the great numbers of both apple and pear leaves bearing their respective perithecia which have been collected from widely separated orchards during the past and present months. The theory of the possible suppression of the ascigerous stage of either of the black-spot organisms therefore is no longer tenable in so far as New Zealand is concerned.

To the orchardist the presence in spring of enormous numbers of ascospores, both in whole leaves and in fragments of leaves, whether these are buried in the soil or lie on the surface of the ground, is of vital importance from the point of view of the future freedom of his orchard from this disease. Although a large proportion of ascospores will not succeed in infecting a host plant, theoretically every ascospore represents one potential source of infection. Then admitting the (low) averages of 200 perithecia per lower surface of each leaf, forty asci per perithecium, and eight ascospores per ascus, the average yield in ascospores per leaf is 64,000. In carefully tended orchards many leaves, of course, are not infected, but in the case of large orchards leaves from the majority of the trees develop perithecia. In a heavily infected leaf there may be 500 or more perithecia to the square inch of leaf-surface, and in one case more than 1,300 perithecia occurred in a square inch.

During the past five or six months dead leaves of apple and pear have been examined at regular intervals by the writer in the expectation of finding perithecia in various stages of development. From such evidence as has been collected so far it would seem that the rate of development of the perithecium is not unduly slow, five to six weeks, or less, usually intervening between the time of the beginning of the formation of the perithecium and that of the maturation of the ascospores.

The data concerning the time of ascospore discharge of *Venturia inaequalis* for the present year are somewhat fragmentary, but even so they offer definite bases for argument. From observations that have

been made elsewhere, chiefly in the United States of America, it is generally accepted that ascospore discharge takes place, with rare exceptions, during or just after wet weather.

Daily Rainfall (in Inches) for August and September, 1921, recorded at the Cawthron Institute, Nelson.

—	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Aug.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·19	..	..	..	..	..	..	..	·21	·09	·1	..
Sept.	..	..	..	..	..	..	..	..	..	..	..	..	·05	..	1·35	2·74	12	·32	·15	..	·03	..	..	..	..	..	..	·30	..	..	..	..

If the above record be consulted it will be seen that on 14th September 0·05 in. of rain fell, that the 15th was rainless, and that from the 16th to 20th heavy rain occurred. Preceding the slight fall on 14th September was a long period of fourteen rainless days reaching back to the wet days of 28th–30th August. Preceding these three days again was another period of seven dry days. Fully mature ascospores were first obtained on 14th September. All the leaves examined on that day bore perithecia, and of these about 55 per cent. were at various stages of immaturity, while the remaining 45 per cent. seemed practically mature. The latter perithecia were more or less swollen, as is usual prior to ascospore discharge, but only a few had attained the full size that immediately precedes the discharge. On 15th September a few discharged ascospores were found. The discharge ceased on the 16th, but started again on the 17th, thence increasing every day during the wet period, and reaching its maximum on the 20th. When it is considered that only about 45 per cent. of the perithecia were mature on 14th September, that no ruptured perithecia were to be seen on the specimens examined on that day, and that during the preceding fourteen days no rain fell, there is at least fair evidence that the discharge on 14th–15th September was probably the first discharge of the season. Should this have taken place earlier, however, it may have occurred during the three wet days, 28th–30th August. It seems most improbable that the state of development of the perithecia could render possible a discharge a week previous to 28th August, which is the nearest earlier date on which it could occur. Even the date 28th–30th August seems unduly early, and it is more probable that for this year 14th–15th September was the time of the first general discharge in the Nelson District of the ascospores of *Venturia inaequalis*.

With reference to the question of ascospores discharge in *Venturia pirina*, the first mature perithecia found by the writer were examined on 24th September. A large percentage of these on every leaf were evidently ready for spore discharge, and, in addition, on a few leaves there were to be seen one or two perithecia that had already set free their ascospores. On the following day an extremely limited discharge took place, the average number of perithecia ejecting ascospores being one per square inch of leaf-surface. On 27th September pear-leaves were collected from an orchard about twenty miles distant from that from which the first set of leaves was taken, and of these some had no empty perithecia, while others again showed a greater number than did the

leaves of 24th September. But even in the leaves gathered on the 27th the percentage of discharged perithecia was not high, in only a few cases reaching 5 per cent. Probably in the two sets of leaves the ascospores had been ejected during the period of wet weather extending from 14th to 22nd September. But it was during this period that it has been suggested that the first ascospore discharge of *Venturia inaequalis* took place. On the other hand, it is a more or less accepted theory that the earlier blossoming of the pear-tree as compared with that of the apple is correlated with an earlier development of the ascospore of *Venturia pirina* on the pear as compared with that of *V. inaequalis* on the apple. It is possible that as the leaves were taken from only a few orchards the state of development of the fungi does not represent the average state of development for the district. Nevertheless, it may be that the time of maturation of the perithecia does not follow that of the blossoming of the host plant as strictly as at present is believed. This is a point of practical interest to the owner of the mixed pear and apple orchard, for at the critical time, when of necessity one tree has to be sprayed first and another last, the order chosen cannot with safety be left to chance. Also, if the correlation of time of development can definitely be proved to exist between host and fungus, there is the further possibility of the occurrence of variation in the time of development of the perithecia of either fungus according to the variety of the apple (or of the pear, as the case may be) upon which it is growing.

The two most important questions demanding attention, however, are those which were mentioned first—namely, confirmation of the earliest time of the maturation and discharge of the perithecia (or proof that they occur earlier than has been suggested in the present article), and, secondly, the obtaining of data bearing upon the possibility of the existence of correlation between the time of blossoming of the host and that of the maturation of the perithecia of the fungus.

POSTSCRIPT.—After the foregoing article had been written and despatched the conidial, summer phase of the black-spot fungus, which has previously been known to occur in New Zealand only on the leaves and fruit, was found to be present in the twigs of a pear-tree growing in Nelson. The twigs infected were chiefly of last year's and the previous year's growth. The tree from which the specimens were obtained is of value for its fine proportions rather than for the fruit it yields. It is neither sprayed nor pruned, and every year is badly infected with black-spot at the blossoming-period, in consequence of which most of the young fruit falls. It stands on a well-kept lawn upon which no fallen pear-leaves are permitted to remain, and there are no other pear-trees in the immediate vicinity whose dead leaves might bear ascospores and so be responsible for the yearly infection. There seems, therefore, to be valid ground for supposing that in this instance the initial infection each season is due to the conidia developed on the twigs. In a well-pruned commercial orchard there is only a small possibility of infected wood being left on the tree, and what little is left is probably prevented by spraying from producing viable conidia. Yet the case of this one tree is worthy of note in that it shows that twigs can be infected by the black-spot fungus; that such twig-infection exists in the Nelson District; that the presence of even a single untended tree near a commercial orchard is a menace to the latter; that although at the present time attention is with justice being focussed upon the stranger within our gates, there is still danger to be expected from the tree itself; and, finally, that although twig-infection has been noticed so far on only one tree, and that a pear-tree, it probably occurs wherever there is lack of attention, on pear and apple trees alike.

A NOTE RECORDING THE PRESENCE IN NEW ZEALAND OF THE PERITHECIAL STAGES OF APPLE AND PEAR BLACK-SPOT.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

ALTHOUGH their presence has been long suspected, the perithecial or perfect stages of the black-spot fungi of apple and pear have not been recorded for New Zealand until this season. On 20th September, from dead leaves from Riwaka, forwarded by Mr. W. T. Goodwin, Orchard Instructor, I succeeded in obtaining perithecia of apple black-spot (*Venturia inaequalis* (Cke) Aderh.). Perithecia of pear black-spot (*Venturia pirina* Aderh.) were obtained three days later. At this time I was unaware that any other person in the Dominion was engaged in a similar investigation or had obtained the perithecia in question. On 14th September, however, Dr. K. M. Curtis, of the Cawthron Institute, had obtained the perfect stage of apple black-spot from leaves collected in an orchard at Riwaka. To Dr. Curtis, therefore, is due the credit of being the first to find the perithecial stage of apple black-spot in New Zealand.

As soon as the perfect stages were known to exist the Department's Orchard Instructors throughout the Dominion were requested to forward specimens, and in all cases on leaves forwarded by them perithecia have been found. Leaves have been sent in from the districts of Auckland, Waikato, Wanganui, Marton, Hastings, Wellington, Motueka, Nelson, Christchurch, and Dunedin. These stages of the fungus thus appear to be widespread, and their presence would indicate that the life-cycle of the New Zealand forms is similar to the American and European forms.

APPEARANCE OF THE PERITHECIA ON THE LEAVES.

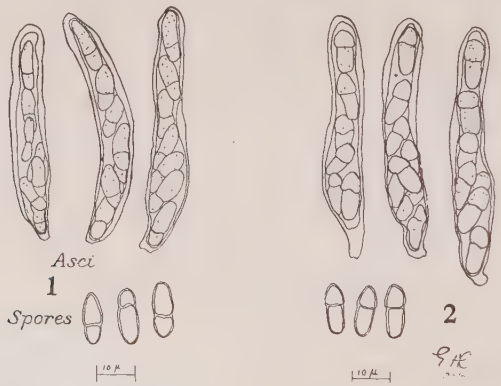
Although not visible to the naked eye, under a magnification of 10 to 15 diameters the perithecia are visible as minute flask-shaped black bodies embedded in the dead tissues on both surfaces, but more commonly on the under-surface of the leaves. Before they are mature they are not visible, but are completely covered by the epidermis. When nearing maturity the necks of the perithecia burst through the epidermis, and it is these necks and not the whole perithecia which are seen when leaves are examined. When they first appear the necks are naked, but when the spores are mature the necks are covered with a few coarse black bristles. I have found the presence of these bristles an excellent guide to the maturity of the ascospores. Perithecia appear to be common only on leaves that have been somewhat protected during the winter. For instance, leaves that have been lying under hedges or under sods have abundant perithecia, whereas leaves which have been lying on the ground and are more or less rotten show few or none.

Each perithecium is more or less flask-shaped, with a minute opening at the apex of the neck. Each contains numbers of small elongated sacs (asci), each of which in turn contains eight unequally two-celled yellowish-green spores (spores are colourless unless mature). The two species closely resemble one another, but can be distinguished

morphologically in several small details of the ascospores (see illustration). They are stated to be biologically distinct, each incapable of infecting any host other than the one it occurs on.

LIFE-HISTORY OF THE FUNGUS.

I hope to deal with this phase more fully when a series of experiments at present under way has been completed. It appears that about blossoming-period the ascospores mature, and when conditions are favourable are abruptly extruded into the air, where they are carried by air-currents to leaves, branches, and fruits. Opinions are divided as to how the ascospores are extruded, some authors being of the opinion that the spores are extruded out of the asci into the perithecia and in turn shot out of the perithecia into the air. Experiments conducted in this laboratory tend to show that in the presence of abundant moisture the whole perithecium explodes, discharging asci and spores with some violence, leaving only the basal portion of



PERFECT OR WINTER-SPORE FORM OF BLACK-SPOT FUNGUS.

Fig. 1. *Venturia pirina.* Fig. 2. *Venturia inaequalis.* Both × 500.

the perithecium embedded in the tissues. A similar condition appears to prevail in nature, as on leaves one commonly finds these embedded bases surrounded by the ruptured tissues.

As to whether the spores are extruded from the asci prior to the exploding of the perithecium I cannot say, but experiments carried out with the asci in the presence of water indicate that the spores are shot out one by one through the apex of the ascus. Once an ascospore has alighted on a leaf or young fruit, if moisture is present it germinates and puts forth a germ-tube which penetrates the tissues, rapidly branches, and gives rise to hyphal masses from which conidiophores are produced. On these conidiophores the summer spores are borne, and it is the presence of these spores that makes the characteristic "black-spot" condition so noticeable on infected fruit and leaves. Each summer spore (conidium) is capable of infecting a fruit, leaf, or young shoot—in fact, it is the conidial stage that carries on the disease throughout the summer months; even in cool store black-spot frequently develops from conidial infection.

It would appear that with pear black-spot the ascospore stage is not essential to the perpetuation of the species, as conidia capable of causing infection are produced the year around. At Weraroa, in 1919, during the months of March to November, once a fortnight I brought cankered pear-shoots infected with the conidial stage of black-spot into the laboratory and proved their viability. During the whole of that time I could readily obtain conidia from infected shoots in the orchard. I cannot say whether this condition prevails with apple black-spot, as I have not seen shoots infected with the fungus, but in Europe a cankered condition of young shoots appears to be common.

When such details as the date when ascospores are first discharged, the presence or absence of conidia throughout the winter on apple-shoots, and the viability and longevity of conidia under field conditions are known, our spray calendar will probably have to be somewhat modified in consequence, particularly with regard to the time of application and strength of the first or "pink" spray.

STRATFORD MODEL DAIRY FARM.

REVIEW OF OPERATIONS AND CROP RESULTS.

J. W. DEEM, Fields Instructor and Supervisor of Subsidized Demonstration Farms.

THE policy followed at the Stratford Model Dairy Farm in previous years was continued in 1920–21, and improvements have been carried out as rapidly as funds would permit. These improvements, in addition to further stumping, fencing, and general cleaning up, include a new residence for the Farm Manager.

The benefits of resowing of pastures, top-dressing, and general cultivation are now making themselves felt in increased productivity, this being greatly reflected in the milk-returns. These for the first year of the farm's operations were 6,314 lb. butterfat, for the second year 7,575 lb., for the third year 8,700 lb., and for the year under review 12,688 lb. This last return shows an increase over the first year of more than 100 per cent., and over the third year of nearly 46 per cent. The average production of butterfat per cow has gone up from 221 lb. in 1919–20 to 253·7 lb. in the past year, this being for fifty head of milking-stock (thirty-two cows and eighteen first-calving heifers). These figures show that the average of the herd is gradually building up, and, although last season in Taranaki could not be considered an ideal one for dairying, the returns are an indication of what can be done by selection and good feeding. The spring of 1920 at Stratford was very late, with an excess of rain, while a dry autumn was experienced. The crops on the whole did well, however, and were the best hitherto produced on the farm.

The farm is being more and more appreciated by the interested public. The various field days were marked by good attendances of farmers, and individual visits were very numerous during the year. The Taranaki Education Board's new agricultural technical school,

which is being erected on land adjoining the farm, is nearing completion, and when this is occupied the teachers and pupils will be able to make more use of the farm.

The Farm Manager, Mr. E. Hartwig, has shown great keenness in the work, and the increased returns of butterfat emphasize the care with which he has handled the herd.

EXPERIMENTAL WORK.

The variety and manurial tests at the farm have now extended over four seasons, and the results are consequently of increased value. It is recognized that anything may happen in one year's tests, but when a certain result is obtained over a number of seasons the finding may be accepted as fairly definite. In the *Journal* for October last year I referred to the position of some of the leading manures in con-

MAIN FARM BUILDINGS AT THE STRATFORD MODEL DAIRY FARM.

The milking-shed, on right, is a four-cow-plant walk-through shed. The middle building is the milk-stand and cart-shed combined. That on the left is an implement-shed and manure-store. All the buildings are constructed of heavily reinforced concrete.

nection with the farm crops, and the past year's results further verify those conclusions, as will be seen by the observations recorded in the matter which follows.

Swedes.

Taking the swede crop first, it is found that the average yields for the four-year period of the plots treated with the respective manures are as follows: Bonedust, basic slag, and superphosphate, 43 tons 10 cwt., first; basic super, 43 tons 7 cwt., second; super and Ephos phosphate, 42 tons 19 cwt., third; Ephos, 41 tons 5 cwt., fourth; super and slag, 37 tons 14 cwt., fifth; and basic slag, 36 tons 16 cwt., sixth. From this it will be noted that the basic super has practically caught up to the bone, slag, and super.

Now, if we take the cost per ton of roots produced in excess of that of the "no manure" area, which gave an average crop of 13 tons 10 cwt., the following figures are obtained: Bone, slag, and super, 1s. 3½d. per ton; basic super, 1s. 0½d.; super and Ephos, 1s. 1½d.; Ephos, 1s. 1¼d.; super and slag, 1s. 3¼d.; basic slag, 1s. 3½d. These figures analysed again place basic super as the most economical manure for the swede crop in the Stratford district. They further emphasize previous statements that almost any good phosphatic manure used at

the rate of 3 cwt. per acre will give good results on average Taranaki land, provided the cultivation is thorough. From our experience at Stratford, coupled with the results from the Toko field competitions, it may be safely said that the difference between a 30-ton and a 40-ton crop of swedes is cultivation, when the manures in question have been applied. For swede crops on the Stratford farm we have practically standardized at 3 cwt. per acre. In the past year 2 cwt. of basic super was tested against 3 cwt. per acre, with the following results: 2 cwt.—39 tons 5 cwt.; 3 cwt.—48 tons 8 cwt.: difference, 9 tons 13 cwt. These findings are substantiated by the data of the field competitions as recorded by the writer in last month's *Journal*.

The poor results from the addition of nitrogen as a manure at the Stratford farm have been further demonstrated in the past year in a test between (1) basic super, (2) basic super and sulphate of ammonia, and (3) basic super and blood. The figures are: Basic super, 52 tons 1 cwt. per acre (9d. per ton); basic super and sulphate of ammonia, 38 tons 14 cwt. (1s. 6d. per ton); and basic super and blood, 43 tons 14 cwt. (1s. per ton). All these tests were carried out in the field, the manure and seed being sown with the ordinary drill.

In varieties Superlative is still in the lead with an average for the last two years of 50 tons 18 cwt., Magnum Bonum coming second with 48 tons 3 cwt., Grandmaster third with 44 tons 19 cwt., and Warrington fourth with 38 tons 15 cwt. Three new swedes—Webb's New Empire and Masterpiece and Sutton's Caledonian—were tested this year. So far as appearances go, Masterpiece is Superlative under another name; of the other two, Caledonian promises well and is worth further trials. Dry-rot was not nearly so bad as in the previous year, but Superlative again showed the most infection. In August the difference between Magnum Bonum and Superlative was very marked.

Soft Turnips.

These were again a good crop last season. The leading varieties for the four years give the following averages: Lincoln Red Globe, 47 tons 2 cwt.; Red Paragon, 46 tons 15 cwt.; Purple-top Mammoth, 45 tons 9 cwt.; Imperial Green Globe, 44 tons 10 cwt.; Hardy Green Globe, 42 tons 13 cwt.; and Romney Marsh, 39 tons 5 cwt. An important point in these figures is the good showing of Lincoln Red and Red Paragon as compared with Purple-top Mammoth. Our experience at Stratford is that the two former are just as quick as Mammoth, and much better keepers. Several new varieties were tested during the year, but none of them is worth special mention.

Our soft turnips at the farm have always been grown with 3 cwt. basic super per acre. When it is mentioned that the best crop in the district field competitions during the last two years was 40 tons 11 cwt., our average of 45 tons 9 cwt. for the four years must be considered satisfactory and an indication that the manure is all right.

Mangolds.

During the past three years a good many varieties have been tested. This past season the crop was confined to four varieties—Prizewinner, Long Red, White Sugar, and Jersey Queen—and the crop was the best we have grown on the farm. These four varieties have given the best results over the period, their average weights for

the four years being as follows: Prizewinner, 49 tons 19 cwt.; Long Red, 47 tons 19 cwt.; White Sugar, 43 tons 18 cwt.; and Jersey Queen, 42 tons 12 cwt.

The most satisfactory manure so far has been super (3 parts), bone (1 part), and slag (1 part) at the rate of 5 cwt. per acre. Potash has been tested, but has not warranted the extra expenditure. Salt was again used at the rate of 3 cwt. per acre, and gave an increase of 14¾ tons per acre. The increase in favour of salt for the four years gives an average of 10 tons 8 cwt. per acre. The main crop of mangolds shows an average of 46 tons 2 cwt. It should also be mentioned that this is the first year we have grown our mangolds on land that had been cropped the previous year, and the results have been better.

Carrots.

The area in this root was increased last season. Like the mangolds, they were grown on land that had been cropped the previous year, and were more uniform and a much better crop than those previously grown. Several varieties have been tested on the farm, but last season the tests were confined to Matchless White, Magnum Bonum, Sinclair's Champion, and Rennie's Short White. For the last four seasons Matchless White has averaged 31 tons 3 cwt., Magnum Bonum 30 tons 14 cwt., and Sinclair's Champion 24 tons 4 cwt. Rennie's Short White was imported from America, and appears to be a selection from Matchless White. It promises well, and will be further tested.

Forage Crops.

These were again grown for haying purposes, and were very good. Sown between 1st and 3rd November, they were ready for cutting by the end of January. The following are the green weights per acre: Algerian oats (2 bushels seeding) and Canadian field-peas (1 bushel), 12 tons 3 cwt.; Algerian oats (2 bushels) and golden tares (1 bushel), 13 tons; grey partridge peas (2 bushels) and horse-beans (1 bushel), 17 tons 18 cwt. This latter crop was in splendid condition for feeding out green to cows, but, not being required, it was allowed to ripen and was then cut and fed to pigs. Growing this crop again I would recommend peas and beans in equal proportions. Golden tares were tested against Scotch or grey tares for spring sowing, and were much more forward at cutting-time. It would appear as if they are the best for spring sowing.

Lucerne.

A small area of lucerne was sown on 4th January last, eight varieties being put under test and the lucerne being grown under different systems of sowing. Lucerne is also being tested against cow-grass sown on the same date in a contiguous area. The idea is to give the cow-grass the same treatment as the lucerne, keeping careful records with a view to ascertaining which is the most economical crop to grow in the district.

Top-dressing Pastures.

The top-dressing experiments in the bush paddock (field 7) are still interesting. Last spring the basic super, and burnt lime and super, areas were the best, with the basic slag close up. This year there is not a great deal of difference between these three plots, but, if anything, the basic-slag plot is the best. Next to the plots specified those dressed with Ephos phosphate, and guano and super, were the best,

and they still hold this position. The plot dressed with Mount Lyall rock phosphate shows no improvement, and so far as appearances go this dressing up to the present has been useless. The area dressed with carbonate of lime and rock phosphate is not much better. These results are very interesting at the present time, when there is so much raw rock phosphate being introduced into the various mixtures. It is quite likely, however, that now these phosphates are being supplied much more finely ground the results will be quicker.

Basic slag (both English and Belgian) has been used this past year for the general top-dressing on the farm. In two fields Nauru phosphate is being tested against slag.

GENERAL.

It will be noted that basic super at the rate of 3 cwt. per acre has been used right through at the farm for soft turnips. It has also given very fine results with swedes, securing second place in yield and only 3 cwt. behind the bone, slag, and super mixture; in fact, when its lesser cost is considered it really stands in first position.

Nauru phosphate is at present exercising the minds of a great many farmers, and great things are expected from it, but it must be remembered that it is to some extent still on trial. In my opinion Nauru phosphate will doubtless very largely replace bone, Ephos phosphate, and basic slag in mixtures, but farmers would be well advised not to use it too freely as a straight-out manure for root crops until it has been tested for a season or two. Mixed with super, half and half, or in wetter localities two of Nauru to one of super, it should give good results. These manures are being tested on the different root crops this season, and it is hoped to have some reliable data by next year.

CONTROL OF EELWORM IN TOMATO-HOUSES.

EXPERIMENTS AT LOWER HUTT.

EELWORM infestation is becoming a serious menace to various crops grown both in the open ground and in glasshouses. Until recently the chief means of control was carbolic acid, but this remedy is expensive, as well as having some further drawbacks. For example, plants cannot be grown in soil treated with carbolic acid until the latter has evaporated, which takes some weeks. Carbon bisulphide is being increasingly used in eelworm control in other countries, and has several advantages over carbolic acid. Last year arrangements were made with Mr. C. W. Howard, Lower Hutt, to conduct some experiments in his tomato-houses, which were infested with eelworm. The tests were carried out entirely by Mr. Howard, who furnishes a report as under. —*Horticulture Division.*

MR. HOWARD'S REPORT.

During the 1920–21 season a series of experiments was undertaken to test the efficacy of carbon bisulphide as a means of controlling eelworm in tomato-houses, a glasshouse measuring 200 ft. by 40 ft. by 14 ft., and having a single-span roof, being set aside for this purpose.

The soil of the house was a made soil—rotten rock, clay turf, road-scrapings, weeds, hay, green grass, green clover, green oats, and stable manure all entering into its composition. Previous crops grown in the house had been fourteen of tomatoes and ten of French beans, also some experimental vegetable plants. Each of these crops had received heavy applications of artificial manures—phosphates, potash, nitrogen, copper, iron, and sulphur—and also of burnt lime. All crops had been good with the exception of the last two crops of tomatoes, which were poor on account of eelworm infestation. The first of these poor crops was from seed grown in eelworm-infested soil, and served to introduce the pest into the soil of the tomato-house. The following crop also failed, leaving the soil very badly infested with eelworms at the time the experiments commenced.

For the purpose of the experiments the glasshouse was divided into four plots, each of which received different soil-treatment. Two of the plots were used to test different methods of applying carbon bisulphide, a third was treated with carbolic acid for purposes of comparison, while the fourth, the control plot, received no special soil-treatment. On 1st April, 1920, the following treatments were given to the plots :—

Plot 1 (80 ft. by 40 ft.) : Holes were made in the soil 20 in. apart, and ½ gram of carbon bisulphide was poured into each hole, which was then plugged. The soil was then watered all over.

Plot 2 (80 ft. by 40 ft.) : The soil of this plot was loose, and was sprayed in strips measuring 3 ft. by 40 ft. with the same aggregate quantity of carbon bisulphide as was used on plot 1. The ground was then flooded with water and afterwards rolled with a heavy roller.

Plot 3 (36 ft. by 40 ft.) : Carbolic acid was sprayed on the soil, which was then heavily watered.

Plot 4 (4 ft. by 40 ft.) : This was the control plot, and no soil-treatment was given. It was situated at the end of the house, and was boarded off from the treated portions.

In order to ascertain the effect of these treatments on newly-set-out plants and on the germination of seeds, plantings were made on each of plots 1, 2, and 3 of ten bean-seeds and ten tomato-plants on the day following treatment. Similar plantings were also made each day for a further twelve days.

On plots 1 and 2 normal growth took place, except that of the beans sown on the third day only three sickly plants came up. On these two plots the tomato-plants at first appeared sickly, but afterwards recovered and grew strongly. On plot 3, treated with carbolic acid, both beans and tomatoes failed entirely. A further treatment of the soil of the three plots on 15th April, followed by similar plantings of beans and tomatoes, confirmed the results of the first test. When carrying out the second spraying of plot 2 some of the bisulphide used got on to the tomatoes already planted and caused a certain amount of damage to the foliage.

Tomato-plants were set out on plot 4 on 1st May and 1st June respectively, but as eelworm-galls soon developed on their roots they were pulled out.

After these tests the plants remaining were rolled in, the plots cultivated, and the ground then left fallow. On 14th July the interior

of the house was bastard-trenched to a depth of 2 ft. 6 in., and applications of potash, phosphates, nitrogen, and lime made. The house was also fumigated with cyanide of potassium.

In addition to the work on the plots, several kerosene-tins were obtained, cut lengthwise into halves, and each half filled with untreated eelworm-infested soil. A quantity of carbon bisulphide, proportionately four times as great as that used on the plots, was then poured into each tin, and four bean-seeds and one tomato-plant were immediately planted in each. All came away well, but the beans, after setting flowers and showing promise of a good crop, had to be removed to make room for the tomatoes. These latter grew to a height of 6 ft. and set five and six bunches of well-grown fruit, only lack of room preventing further growth.

For the purpose of the main experiment tomato-seed of the Chemin Rouge variety was sown early in June. On 14th June some of the plants were pricked out into boxes containing soil which had been treated with carbolic acid in April and held in readiness for this purpose. Others were transferred to boxes of soil which had recently been treated with carbon bisulphide. Planting-out was done on 1st August, when the four plots in the tomato-house were filled. Owing to the plants in the boxes of bisulphide-treated soil having suffered severely from frost on 26th June, it was necessary to set out in plots 1 and 2 plants which would otherwise have been rejected.

In all treated plots the plants made good growth and produced an exceptionally fine crop, picking commencing on 5th November and continuing until the following July. The plants were unusually free from disease, except for a rather heavy infection of black-stripe, and on examining all roots for traces of eelworm-gall the percentage of infection was found to be only 1·2, or 12 in 1,000. Even these infected plants bore a good crop.

On plot 4, as indicated, no soil-treatment had been given, but otherwise the plants were grown as on plots 1, 2, and 3. Here the eelworm took complete control, resulting in an absolute failure of the tomato crop.

CONCLUSIONS.

These experiments demonstrated that both carbon bisulphide and carbolic acid are effective as a medium for soil-treatment in control of eelworm, but that at least two years are required to effect a complete clearance. Of these two remedies the bisulphide treatment should prove more suitable for the commercial grower, owing to the fact that plants cannot be grown in soil treated with carbolic acid until some ten or twelve weeks after the application has been made.

Both methods of using bisulphide—spraying the surface of the soil, and saturating it by means of holes—are suitable, and are equally effective, but with a hollow rod and two valves the holes can be done quicker. In both cases the house should be closed during and for some hours after treatment, and care should be taken to prevent the highly inflammable gas given off from becoming ignited, no smoking being allowable.

Carbon bisulphide apparently does the plants no harm, and even has a fertilizing effect, it being noted in all cases where it was used that plants at first showed a forced growth as though from an excess of nitrogen, but afterwards hardened off in a normal manner.

WINTON EXPERIMENTAL AREA.

NOTES ON RECENT OPERATIONS.

THIS being the first occasion on which the Winton Experimental Area has been comprehensively reported on in the *Journal*, it may be stated that the area is situated near the town of that name, about twenty miles northward from Invercargill, in the basin of the Oreti River. The area comprises some 60 acres of good flat land, mostly medium loam soil. It was taken over by the Department in 1918, and the development-work has consisted largely of draining and cleaning operations. In the 1919–20 season the main crop (apart from swede dry-rot experimental plots) was oats.

The area is to be largely devoted to a consideration of the economics of pasture production and maintenance, matters of fundamental importance to Southland agriculture. Among the first problems requiring solution is whether the average profitable life of Southland pastures on similar land—which at present commonly last only two to four years before running into undesirable types of vegetation, such as couch-grass—can be economically extended by attention to top-dressing, selection of grasses and clovers employed, and regulation of stocking. On the other hand, the economics of quite temporary pastures as against those of longer rotation has to be determined. A start along these lines has now been made.

The following detailed account of the various operations carried out on the area during the season of 1920–21 is supplied by Mr. W. Alexander, Fields Instructor, Invercargill.

SECTION 1 (5 ACRES). COMPARATIVE PRODUCTION OF GRASSES SOWN PURE.

This section was divided into five equal plots, and sown out with the following pure grasses: (1) Meadow-foxtail (colonial), 20 lb. per acre; (2) meadow-fescue, 30 lb.; (3) fiorin, 10 lb.; (4) perennial rye, 30 lb.; (5) cocksfoot (Akaroa), 20 lb.; (5A) cocksfoot (Danish), 20 lb. Plots 5 and 5A are 1 acre together.

SECTION 2 (5 ACRES).

This is a continuation of the scheme started on section 1, and is also divided into five 1-acre plots. It was sown out as follows: (1) Timothy (Canadian), 20 lb. per acre; (1A) timothy (Southland), 20 lb.; (2) crested dogstail, 20 lb.; (3) Poa pratensis, 15 lb.; (4) Poa trivialis, 20 lb.; (5) Yorkshire fog, 20 lb.

In addition to being sown out in grasses, sections 1 and 2 carry a liming trial whereby the entire area of 10 acres was divided into three strips and given the following applications of lime: (1) Crushed limestone, 3·6 tons per acre; (2) control (unlimed); (3) crushed burnt lime, 2 tons. The lime was applied in October, and the grasses were sown across the strips at the end of November. No manures were used on the grasses, nevertheless the germination and subsequent growth were quite satisfactory.

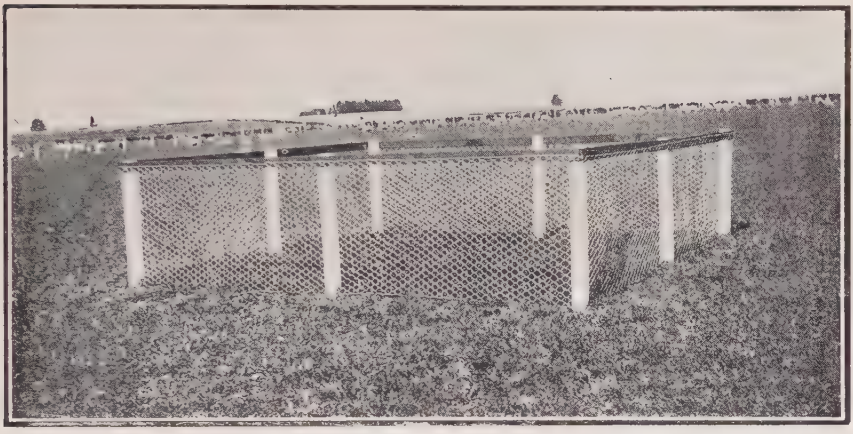
Grazing commenced on 10th February, and was intermittent until 5th June. Twice during this grazing-period the area was chain-harrowed, and showed considerable improvement as a result. The

stock carried over the period of ten weeks equalled 4·7 sheep per acre, and an earning-capacity of 7s. 11d. per acre when reckoned at 2d. per head per week. The grasses are all established well, and promise to be much improved by another year.

Areas 12 ft. by 12 ft. have been enclosed throughout sections 1 and 2 (one on each pure sowing), and a start has been made cutting the grass in these enclosures for the purpose of recording actual growth made during the year.

SECTION 3 (5 ACRES). SHORT-ROTATION PASTURE.

The liming scheme underlying the crop work on this area is the same as that which underlies sections 4, 5, 7, and 9, and is as follows: (1) Crushed burnt lime, 1 ton per acre; (2) crushed burnt lime, 2 tons; (3) control (unlimed); (4) crushed limestone, 1·8 tons; (5) crushed limestone, 3·6 tons. The lime was applied in October, 1920, and the grass was sown in the following November. The grasses



ONE OF THE NETTED ENCLOSURES USED FOR RECORDING GROWTH OF PASTURE.

comprise a short-rotation mixture consisting of 40 lb. perennial rye-grass, 6 lb. Italian rye-grass, 3 lb. red clover, and 2 lb. white clover; total, 51 lb. per acre. A hurdled enclosure for growth-recording purposes has been erected on the strip treated with 1 ton crushed burnt lime. Grazing commenced on 10th February, and was intermittent until 14th June, by which time the pasture had earned, at 2d. per head per week, just 18s. 1d. per acre, equal to a carrying-capacity of 10·8 sheep per acre for a period of ten weeks.

SECTION 4 (5 ACRES). PERMANENT PASTURE.

This area was limed in October as for section 3, and sown out to permanent grass on 27th November. The mixture used was as follows: 7 lb. perennial rye-grass, 14 lb. Danish cocksfoot, 7 lb. meadow-fescue, 4 lb. meadow-foxtail, 3 lb. Poa trivialis, 3 lb. crested dog's-tail, 3 lb. timothy, 2 lb. Poa pratensis, 3 lb. red clover, 2 lb. white clover, and 1 lb. Lotus major; total, 49 lb. per acre.

Grazing commenced on 10th February, and was carried on at intervals until 14th June, by which time this pasture had carried for a

ten-weeks period nine sheep per acre, and at 2d. per head per week had earned 15s. per acre. The grass on this section has established well, and promises to become an excellent pasture.

SECTION 5 (5 ACRES). TEMPORARY PASTURE.

This area was also limed as for section 3, and was sown down in November to temporary pasture, a mixture consisting of 40 lb. Italian rye-grass, 4 lb. red clover, and 2 lb. alsike per acre being used. As in the other grass sections, this one was stocked intermittently from 10th February until 5th June, by which time 13s. per acre had been earned, and a carrying-capacity shown of 7·7 sheep per acre over a period of ten weeks. While this was an excellent grass-paddock and carried quite a lot of stock, it did not prove to be so good during this first season as the short-rotation pasture on section 3. When observations were taken in September, however, the grass on section 5 seemed to have got over the winter easiest of all, and was again carrying stock, while the other grasses were only just beginning to come away. The netted enclosure for this section is placed on the 1 ton crushed burnt lime strip.

In reckoning out the earning-capacity of these grass sections 2d. per head per week was adopted as the basis, because that was the price being paid for grazing in May. Had the sheep been our own which we were fattening, or had they been in-lamb ewes, the earning-capacity would certainly have been much higher. Although not showing the maximum earning-capacity, the figures given are still valuable from a comparative point of view.

SECTION 6 (5 ACRES). POTATO TESTS.—SWEDE DRY-ROT INVESTIGATION.—WINTER FORAGE CROPS.

Potato Tests.

The first acre in this section was devoted to trials in connection with the investigation of powdery scab in potatoes. Both scabby and clean tubers were planted under varying conditions, but the results have so far been consistent in that there is no powdery scab in the crop at all. The results in detail, together with those of experiments to determine the effect which the origin and the size of seed have on yield, and of tests of certain potato varieties, are given in the following tables :—

Treatment for Control of Powdery Scab.

Plot No.	Seed Tubers.	Treatment of Soil and Seed.	Yield per Plot.			
			Table.	Seed.	Small.	Total.
			lb.	lb.	lb.	lb.
1	Scabby ..	No lime	28	4	4	36
2	,, ..	3 tons crushed limestone per acre	24	4	2	30
3	,, ..	Corrosive sublimate ; no lime ..	114	25	17	156
4	,, ..	Corrosive sublimate ; 3 tons limestone per acre	66	10	8	84
5	,, ..	Formalin ; no lime	52	12	10	74
6	,, ..	Formalin ; 3 tons limestone per acre	72	30	18	120
7	Clean medium	No lime	130	64	42	236
8	,,	3 tons limestone per acre ..	70	30	26	126

Origin of Seed Trials.

Plot No.	Variety.	Origin of Seed.	Yield.			
			Table.	Seed.	Small.	Total.
			lb.	lb.	lb.	Cwt. lb.
1	Arran Chief ..	Southland	188	126	134	4 0
2	,, ..	Canterbury	200	210	148	4 110
3	,, ..	Pukekohe	84	48	32	1 52
4	Gamekeeper ..	Southland	140	134	98	3 36
5	,, ..	Canterbury	178	160	102	3 104
6	,, ..	Palmerston North ..	136	204	114	4 6

Size and Form of Seed Trials.

Plot No.	Variety.	Size and Method of Planting.	Yield.			
			Table.	Seed.	Small.	Total.
			lb.	lb.	lb.	Cwt. lb.
1	Arran Chief ..	Very small	190	180	98	4 20
2	,, ..	Medium size	222	198	82	4 54
3	,, ..	Table size, uncut	116	178	110	3 68
4	,, ..	,, cut	58	40	26	1 12
5	,, ..	Stem end planted ..	120	70	44	2 10
6	,, ..	Rose end planted ..	130	70	38	2 14
7	,, ..	Medium size	200	138	70	3 72

Potato Variety Trials.

Plot No.	Variety.	Yield.			
		Table.	Seed.	Small.	Total.
		lb.	lb.	lb.	Cwt. lb.
1	Arran Chief	160	250	186	5 36
2	Snowdrop	240	210	102	4 104
3	British Queen	32	98	110	2 16
4	Snowflake	34	20	16	0 70
5	Breeze's Prolific	36	74	80	1 78
6	Manhattan	8	36	68	1 0
7	Dakota	96	80	62	2 14
8	Russett	156	156	110	3 86
9	New Era	52	164	162	3 42
10	Gold Coin	30	46	80	1 44
11	Up-to-Date	10	24	36	0 70

NOTE.—Plots in all the potato trials were of equal area.

Swede Dry-rot Investigation.

This test was designed by the Biology Section of the Department, and the work connected with it is in their hands. There had been no appearance of dry-rot until within a month of writing, and when infection occurs so late in the season the disease never gets past the brown surface-spotting stage. There being no information to gain from this area the roots were fed off with sheep.

Forage-crop Varieties.

This test was carried out for the purpose of obtaining information as to the most suitable varieties of the different winter forage crops for growing in Southland. Some twelve varieties of kohlrabi, seventeen varieties of field-cabbage, and ten varieties of kale were sown.

Kohlrabi did not prove a success. The germination was poor in all cases, and the subsequent growth was not encouraging. Rabbits seemed to prefer this crop to any other on the area, and were most destructive. Of the twelve varieties tried, the best of a poor lot might be placed in the following order: Webb's Imperial Green, Vilmorin's Large White, Vilmorin's Large Purple, Webb's Large Purple.

The cabbage varieties were on a whole a very mixed lot, and would require to be separated into groups according to the time of their coming to maturity. Some varieties promise well and are worth further testing, the best of these being Webb's Champion Drumhead, New Early Drumhead, and New Early Flockmaster; Garton's Large Cattle Drumhead, Early Drumhead, Giant Purple Flat Poll, and Selected Drumhead Savoy; Kelway's Drumhead or Scotch; and Vilmorin's Late Flat Dutch and Savoy Tours.

Kale is a crop which has undoubtedly come to Southland to stay, and will soon take a large part in providing supplementary forage of a desirable sort. There have been no failures in our attempts to grow kale on the Winton Area. The varieties at present growing are all good, and can be recommended with confidence. These are as follows: Garton's Green-stem Marrow and Purple-stem Marrow; Webb's Purple-stem Marrow and Green-stem Marrow; and Vilmorin's Jersey Tree, Large-leaved Upright Jersey, Poitou Thousand-headed, Polo's Improved Branding, Marrow-stem White, and Marrow-stem Red.

Definite figures as to yield per acre of these winter-forage-crop varieties cannot be given, as they were mostly single-row plots, and only observational records were kept. All the varieties named in this report are, however, worthy of being further tested.

Winter Forage Crops.

Five winter forage crops—namely, Thousand-headed kale, chou moellier, swedes, kohlrabi, and cabbage—were grown for the purpose of ascertaining their respective carrying-capacities and fattening-qualities. Unfortunately, the germination was most uneven, and this experiment had therefore to be abandoned.

Soft Turnip and Swede Varieties.

An interesting variety trial of soft turnips and swedes was carried out, and it is hoped that this trial will result in the adoption of one or two varieties new to Southland. Of the twelve varieties of soft turnips tried out none were really poor croppers, while two or three varieties show very encouraging results. The varieties tested comprise the following: Webb's Invincible Yellow-fleshed, Renown Yellow-fleshed, Yellow Tankard, Green-top Scotch Yellow-fleshed, Purple-top Scotch Yellow-fleshed, Yellow-top Scotch, Aberdeen Green-top Yellow-fleshed, Aberdeen Purple-top Yellow-fleshed, and Green Globe White-fleshed; and Kelway's First in the Field, Early Red Globe, and Green Ring. The first three varieties named are the best of a good average lot, and are each well worthy of a further try out.

The swede varieties do not show up to advantage, though the majority of lines have yielded quite well. Taking the already well and favourably known Superlative variety as a standard of comparison, it has been found that none of the thirteen varieties now being tried are likely to replace the Superlative. Though all are fairly good, they still fall short of our main cropper. The varieties under test are as follows: Webb's Imperial, New Empire, Giant King, Arctic, New Masterpiece, Buffalo, Selected Hardy White, Short Top, and Golden Melon; and Kelway's Best of All, Dominion Bronze-top, Longport's Green-top, and Brown's Universal.

SECTION 7 (5 ACRES). SUMMER FORAGE CROPS.

This section was limed as for section 3, and the following forage crops sown: Rape, Buda kale, Thousand-headed kale, Italian rye-grass, and Western Wolths rye-grass.

It was originally intended that these 1-acre plots should be grazed with sheep—the sheep to be weighed on and off the crops, and the weights recorded along with particulars as to weight of crop per acre and carrying-capacity. So far we have not had the means of weighing stock, and also have had to be dependent on borrowed sheep with which to carry out such grazing-tests. The result is that we have been able to record only carrying-capacity.

Each plot was fenced independently, and the first plots to be grazed were the Italian and Western Wolths rye-grass areas. When these plots were eaten off the remaining areas were treated. The carrying-capacity results were as follows: Rape carried 100 sheep for 11 days; Buda kale, 100 sheep for 11 days; Thousand-headed kale, 100 sheep for 8 days; Italian rye-grass, 99 sheep for 8 days; and Western Wolths rye-grass, 99 sheep for 7 days.

To secure accurate results the two last-named plots should have been fed off at least six or eight weeks earlier than was the case, as at time of stocking they had gone back considerably as a result of being allowed to seed. On the other hand, the Thousand-headed kale had to be fed off at too immature a stage to secure maximum results. There is no doubt that a series of forage crops similar to that grown in this section would prove most valuable to dairy-farmers during the critical dry summer months. The Western Wolths would come on earliest, and successive stages would eventually bring the Thousand-headed kale into its proper turn towards the end of the season. The Buda kale was entirely cleaned up, being much relished by the stock, which did very well on it.

SECTION 8 (5 ACRES). OATS FOR CHAFF.

Garton oats from the Gore Experimental Area were sown here on 11th October, the seeding being at the rate of 4 bushels per acre, and the manure 3 cwt. basic super per acre. The crop, cut and stacked in March, yielded 2½ tons chaff per acre.

SECTION 9 (5 ACRES). HAY OR ENSILAGE CROPS.

Five 1-acre blocks, limed as for section 3, were sown out on 29th November in the following mixtures: Rye-corn and tares; oats and tares; barley and tares; wheat and tares; and Western Wolths with red and crimson clover.

Each of the five crops was a success, although, as was to be expected, the yields per acre varied considerably. The most consistent feature on this section was the marked increase in yield from limed areas as against unlimed. From the results obtained it cannot be said definitely whether carbonate or burnt lime gives the greater yield, but there is no doubt that lime of any sort is an advantage. Oats and tares appear to be the best mixture of all those tried. Of the others, the wheat rusted badly, the rye-corn ripened ahead of the tares, while the barley yielded very little in comparison with the oats.

The detailed yields per acre (green weight) are given in the following table :—

Mixture and Seeding.	1 Ton Burnt Lime.	2 Tons Burnt Lime.	Control (no Lime).	3·6 Tons Carbonate of Lime.	1·8 Tons Carbonate of Lime.
	Tons.	Tons.	Tons.	Tons.	Tons.
Rye-corn, 2 bushels ; tares, 1 bushel ..	6·84	7·98	3·90	5·82	7·39
Garton oats, 2 bushels ; tares, 1 bushel	7·19	6·87	4·17	6·52	9·12
Cape barley, 2 bushels ; tares, 1 bushel	5·06	3·34	1·61	4·25	6·08
Red Tuscan wheat, 2 bushels ; tares, 1 bushel	9·22	9·17	7·14	7·82	8·96
Western Wolths rye-grass, 30 lb. ; red clover, 6 lb. ; crimson clover, 6 lb.	..	3·28	2·15	2·50	2·78

SECTION 10 (5 ACRES). LINSEED.

This area was put down in a commercial crop of linseed, but sowing was carried out rather late for best results. Seeding took place on 18th November, when 60 lb. seed per acre, together with 3 cwt. basic super, was sown. The crop was not stacked until April, and threshing was carried out in July, when 25 cwt. of mill-dressed seed was realized. The sample of seed was very good.

Acacia Baileyana.—This species is not considered suitable as a hedge-plant, being short-lived—generally about eight years. It is usually grown as an ornamental shrub, and by itself is liable to be badly broken by heavy winds.

Linseed-growing on Gum Land.—A crop of linseed was successfully grown at the Albany Experimental Area, near Auckland, last season. The seeding was 1 bushel per acre, and the manuring 3 cwt. per acre of equal parts of basic super and blood-and-bone. The estimated yield was 18 to 20 bushels per acre. The Department's Chemist reported that the sample was an excellent one, showing an oil content of 41·54 per cent. and moisture 9·30 per cent. This trial possesses additional interest considered in connection with the recent establishment of linseed-oil-cake works near Auckland.

Foul-brood in Bees.—The "foul-brood" so often mentioned in beekeeping literature in New Zealand is the American ropy type. It is really the only serious disease our apiarists have to contend with. The strenuous efforts made for a number of years to keep it within bounds have not been without encouraging success, as it has completely disappeared in a number of districts. It is liable, however, to reappear at any time, and constant vigilance has to be observed. One of the chief causes of its spread is the throwing on the rubbish-heap honey-containers that have not first been thoroughly washed.

TESTING OF PUREBRED DAIRY COWS.

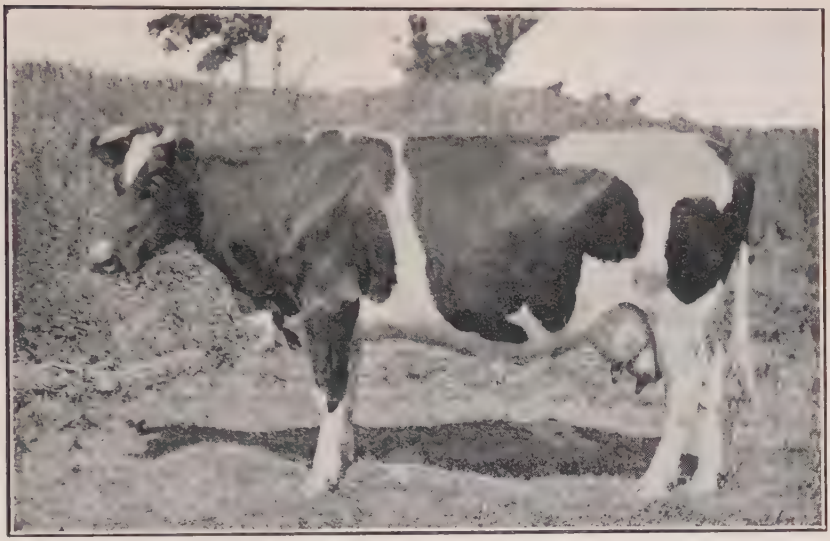
CURRENT CERTIFICATE-OF-RECORD LIST.

THE following list, comprising the records of cows which have qualified for certificates during July, August, and September, 1921, is supplied by the Acting Director of the Dairy Division, Mr. W. M. Singleton :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Bridgeview's Rose ..	A. L. Hooper, Stratford	1 308	240·5	365	7,847·30	521·76
Oakvale's Flossy ..	A. C. Lovelock, Woodville	2 15	242·0	365	7,048·30	436·20
Woodlands Fair Maid	H. C. Sampson, New Plymouth	1 316	240·5	347	7,370·00	433·78
Fairfield Trilby ..	F. J. B. Ryburn, Ohaupo	2 45	245·0	349	6,088·70	406·90
Rangiatea Queen ..	H. A. Lurman, Otorohanga	1 321	240·5	360	7,459·00	404·10
Ensley Jem ..	R. F. Wilkinson, Pukekohe	1 327	240·5	365	6,410·00	404·00
Dalethorpe's Pride ..	A. R. Clark, Hamilton	1 352	240·5	365	8,229·80	403·25
Golden Owlet of Bull's	F. J. Watson, Bull's..	2 8	241·3	364	6,316·40	350·93
Opridess	W. H. Jury, New Plymouth	1 338	240·5	365	7,179·50	347·11
Virginia's Best ..	J. S. Jones, Bell Block	1 325	240·5	364	5,690·40	345·71
Willowbank Gipsy ..	T. Ranford, Whakaronga	1 354	240·5	294	6,053·30	342·13
Countessa	A. J. Luxton, Omata..	1 350	240·5	295	5,937·10	334·90
Victory	F. J. B. Ryburn, Ohaupo	1 359	240·5	336	5,330·90	329·00
Auroa's Jewel ..	J. C. Duff, Auroa ..	1 227	240·5	365	5,032·00	318·05
Laurel's Sunbeam ..	F. Cresswell, Palmerston North	2 19	242·4	322	5,804·10	308·44
Piakau's Jewel ..	A. E. Western, Hawera	1 344	240·5	364	5,197·90	308·18
Swan's Maid's Echo	J. F. Vosper, Matamata	2 45	245·0	341	5,756·60	306·28
Laurel's Shiny Gem..	F. Cresswell, Palmerston North	1 328	240·5	327	6,230·00	305·02
Laurel's Queen Bee..	F. Cresswell, Palmerston North	1 326	240·5	349	5,838·50	302·11
Oakden Lennetta ..	A. L. Hooper, Stratford	2 46	245·1	261	5,121·30	301·17
Leighurst's Gloss ..	C. H. Sharp, Te Roti..	2 82	248·7	242	5,655·85	286·62
Melia Ann's Last ..	A. H. Gilbert, Lepperton	1 351	240·5	180	4,456·75	279·50
Meadowvale Philomel	E. O'Sullivan and Sons, Tariki	1 362	240·5	279	4,967·10	277·28
Bess's Passion Flower	J. B. Groom, Bell Block	1 363	240·5	238	4,570·40	270·22
Plush	W. Fergus, Ruawhata	1 334	240·5	287	5,231·40	267·74
Laurel's Raindrop ..	F. Cresswell, Palmerston North	2 1	240·6	323	5,518·20	260·29
Oleander's Pet ..	W. J. Chynoweth, Cambridge	1 320	240·5	334	4,593·40	241·29
Senior Two-year-old.						
Reid Park's Maiden..	R. F. Wilkinson, Pukekohe	2 252	265·7	365	8,607·40	467·17
Blackberry Chase ..	A. J. Dempsey, Horsham Downs	2 94	249·9	365	7,500·80	464·99
Golden Favourite ..	F. Phillips, Otorohanga	2 313	271·8	342	8,494·50	464·58
Rozel's Breeze ..	J. B. Clemow, Stratford	2 319	272·4	365	7,907·90	457·49

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Senior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Dolly Petune ..	S. R. Lancaster, Palmerston North	2 246	265·1	365	9,391·75	445·66
Sunglow's Sunflower	R. B. Godfrey, Pahiatua	2 339	274·4	365	7,553·70	444·12
Black Lily	J. Scheuber, Kaponga	2 361	276·6	289	7,175·10	397·93
Keithdale Buttercup	J. Fulton, Whangarata	2 359	276·4	365	6,121·80	378·48
Jacinta	A. R. Bayly, Omata ..	2 97	250·2	312	6,301·55	351·15
Young Rose Maitland	C. Parker, Hairini ..	2 242	264·7	255	5,970·90	303·08
Three-year-old.						
Nawa	H. Salway, Bell Block	3 296	306·6	365	9,896·00	609·30
Maid's Monella ..	A. Hazelton, Waihou	3 225	299·5	348	8,141·90	524·91
Avoca's Queenie ..	J. Penny, Mangatoki	3 352	312·2	365	9,644·75	524·58
Pet's Dimple ..	A. Hazelton, Waihou	3 280	305·0	348	8,004·10	516·30
Park Queen's Mary ..	J. R. Colson, Waihou	3 362	313·2	354	9,545·15	511·47
Meadowvale Gold Painting	E. O'Sullivan and Sons, Tariki	3 307	307·7	325	9,577·50	504·59
Hillcrest's Record Faith	J. M. Barriball, Waiuku	3 2	277·2	365	9,105·90	493·84
Maori Nikau ..	R. Clark, jun., Waiau Pa	3 251	302·1	299	8,535·40	410·99
Tumanako Dainty ..	P. F. Kelly, Timaru ..	3 237	300·7	365	7,263·50	397·93
Laurel's Havelock ..	F. Cresswell, Palmerston North	3 5	277·5	365	6,080·10	376·49
Aberbrothock's Mayflower	A. R. Valder, Arapohue	3 17	278·7	363	7,788·70	370·63
Lady Constantine ..	A. B. Robertson, Hawera	3 343	311·3	316	6,265·70	357·22
Collingwood's Ruby	Mrs. E. Hellyer, Dunedin	3 218	298·8	284	6,922·10	356·53
Bachelor's Flower ..	W. Luxton, Waitoa ..	3 58	282·8	306	5,815·30	349·26
Victoria's Noble Queen	J. Meuli, Normanby ..	3 247	301·7	292	5,933·20	342·52
Miss Owlet ..	A. J. Edwards, Ohaupo	3 12	278·2	334	5,502·40	317·28
Queen of Inaha ..	A. H. Gilbert, Lepperton	3 15	278·5	181	5,234·25	315·29
Four-year-old.						
Snow View's Queen ..	K. Rothe, Kaponga ..	4 22	315·7	340	8,995·90	603·27
Bay View Lass ..	J. Nicolson, Hawera ..	4 59	319·4	297	9,263·10	557·72
Veletta	A. R. Clark, Hamilton	4 34	316·9	365	9,444·10	515·46
Red Gold	G. E. Cowling, Manaia	4 327	346·2	365	7,594·90	486·72
Princess Moutoa ..	E. P. Binns, Feilding ..	4 345	348·0	344	8,389·07	476·59
Oakden Jersey Lass ..	J. Scheuber, Kaponga	4 311	344·6	318	7,015·20	442·58
Gladys's Silver Pet ..	J. F. Vosper, Matamata	4 262	339·7	361	7,499·80	403·43
Ivondale's Carnation	P. J. Petersen, Waitara	4 335	347·0	272	6,454·40	379·06
Lovely Deem	R. Chilcott, Frankton Junction	4 348	348·3	338	7,846·70	377·40
Hill Tawa	R. L. Tippler, Shannon	4 317	345·2	326	6,872·20	366·41
Beautiful May ..	J. H. Dobson, Kaimata	4 276	344·1	297	5,874·30	357·97
Buttercup's Daisy ..	R. Chilcott, Frankton Junction	4 324	345·9	342	7,400·20	357·72
Mature.						
Lady Quickstep ..	Mrs. M. A. Gadsby, Stratford	9 7	350·0	365	9,019·10	588·12
Oaklea's Belle ..	S. J. Bennett, Kaupokonui	8 288	350·0	365	8,575·20	540·27
Oakdale Flower ..	D. L. A. Astbury, Mangatoki	8 320	350·0	361	10,686·40	540·00
Perfect Fox ..	G. B. Hull, Silverstream	7 303	350·0	364	10,447·60	512·20



ROSEVALE COLANTHA.

C.O.R.: 4 years 237 days; in 365 days, 18,113·3 lb. milk, 627·17 lb. butterfat.

RAINBOW'S GLEAM.

C.O.R.: 6 years 321 days; in 365 days, 11,094·1 lb. milk, 608·73 lb. butterfat.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Lily's Beauty ..	A. H. Guy, Mangatoki	6 9	350·0	292	9,112·30	508·85
Queen of Bull's ..	H. A. Lurman, Otorohanga	6 296	350·0	343	8,806·50	488·10
Myra See	W. T. London, Tauranga	7 282	350·0	322	8,757·90	462·31
Poppy of Bull's ..	H. A. Lurman, Otorohanga	5 273	350·0	365	8,049·50	454·85
Comely	A. and J. O'Donnell, Inaha	5 267	350·0	307	8,917·40	454·42
Soumise Tulip ..	G. H. Bell, New Plymouth	8 15	350·0	302	7,529·70	434·81
Barbury's Queen ..	A. Hazelton, Waihou	8 26	350·0	344	7,619·70	420·52
Lady Smith ..	R. D. Dagg, Kaponga	7 334	350·0	311	7,812·90	407·55
Dusky Princess ..	S. Atkinson, Papatoetoe	7 42	350·0	262	6,999·40	396·98
Lady Winnock ..	G. E. Cowling, Manaia	8 8	350·0	365	7,844·90	393·07
Oakleigh's Chase ..	W. Luxton, Waitoa ..	6 65	350·0	320	5,855·10	390·75
Ivondale's Lady's Maid	P. J. Petersen, Waitara	6 306	350·0	287	6,378·20	378·72
Pencarrow's Violet ..	R. Chilcott, Frankton Junction	6 334	350·0	350	8,038·00	363·40
Venus of Bull's ..	H. A. Lurman, Otorohanga	7 352	350·0	331	5,877·10	355·76
Lucinda	A. L. Hooper, Stratford	7 49	350·0	259	6,143·10	352·32
Ivondale's Beauty's Maid	P. J. Petersen, Waitara	6 6	350·0	304	7,008·80	350·83
	FRIESIANS.					
Junior Two-year-old.						
Brentwood Queen Molly	Bloomfield Farm Co., Upper Hutt	1 300	240·5	341	11,749·90	529·66
Frien's Mercedes Aquila	D. Dickie, Wellington	1 295	240·5	365	14,818·60	514·98
Brookdell Galatea Beauty	T. Perry, Mangatoki	1 233	240·5	365	12,736·50	453·87
Bounty of Craigneil..	D. Ross, Te Awamutu	2 27	243·2	298	9,256·30	309·22
Peria Belgian Lass ..	J. H. Wilson, Matamata	1 326	240·5	306	7,629·80	290·22
Peria Princess Rozine	J. H. Wilson, Matamata	1 353	240·5	294	7,046·40	262·37
Colantha Johanna Pride II	C. Mayhead, Midhirst	2 25	243·0	302	6,851·20	248·10
Senior Two-year-old.						
Cordyline Cherry Cheer	G. Aitchison, Kaitangata	2 300	270·5	273	13,800·50	480·66
Ardmore Plum III ..	W. Potter, Mangere ..	2 263	266·8	365	9,626·70	345·04
Brunswick Jewel ..	A. B. Walker, Hawera	2 259	266·4	337	6,614·00	266·93
Junior Three-year-old.						
Bainfield XVI ..	W. D. Hunt, Invercargill	3 44	281·4	365	17,859·00	637·18
Senior Three-year-old.						
Edgewood Pearl ..	Bloomfield Farm Co., Upper Hutt	3 280	305·0	365	16,808·70	668·83
Very Fine	S. Knight and Sons, Ongarue	3 297	306·7	321	11,069·90	438·20
Viola Countess de Kol	Parkinson Bros., Opotiki	3 338	310·8	327	11,642·20	347·20
Oaklea Canary Fobes	S. Knight and Sons, Ongarue	3 349	311·9	267	9,692·00	343·36
Okoroire Nannie III	J. H. Wilson, Matamata	3 327	309·7	289	8,725·30	326·65

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Senior Four-year-old.		Yrs. dys.	lb.		lb.	lb.
Duchess o' Gowrie ..	E. J. Betts, Okaiawa	4 277	341·2	342	10,950·30	355·30
Mature.						
Hilda Minto de Kol..	C. H. Steadman, Whangarei	10 116	350·0	365	22,922·00	738·07
Cordyline Betty Hengerveld	C. E. Robertson, Palmerston North	5 300	350·0	345	14,492·60	542·24
Alcartra Pietje Pride I	J. J. Walker, Ohangai	6 288	350·0	323	14,121·60	509·21
Queen o' Gowrie ..	A. B. Walker, Hawera	6 214	350·0	332	12,274·40	410·05
Monavale Claudia Paxton	J. H. Wilson, Matamata	5 24	350·0	304	10,268·50	401·22
Colantha Solkye Wieman	S. Knight and Sons, Ongarue	6 292	350·0	298	12,463·90	393·04
	MILKING SHORTHORNS.					
Junior Two-year-old.						
Pine Farm Nina IV..	J. Parkinson, Opotiki	1 298	240·5	365	7,391·40	333·85
Junior Three-year-old.						
Cloverlea Queen ..	D. Buick, Palmerston North	3 11	278·1	270	7,368·90	300·83
Miss Massey A ..	J. M. Whitham, Waiuku	3 25	279·5	305	7,331·50	285·88
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	*	350·0	365	12,910·20	550·05
Glenthorpe Daisy ..	A. J. Melville, Buckland	*	350·0	365	10,874·80	519·46
Glenthorpe Countess	A. J. Melville, Buckland	*	350·0	325	9,323·70	362·41

* Mature.

Fellowship of the New Zealand Institute.—Among those last elected to this fellowship (F.N.Z.Inst.) is Dr. F. W. Hilgendorf, Biologist to the Canterbury Agricultural College, Lincoln.

Samples and Specimens for Examination.—The Officer in Charge of the Veterinary Laboratory, Wallaceville, wishes again to notify that specimens are frequently sent to the Laboratory imperfectly marked or not marked at all, making identification difficult and sometimes impossible. In addition to the letter of advice, bottles or other containers should be properly marked, or a note enclosed giving the name and address of sender.

Control of Piripiri ("Biddy-biddy").—Small patches of piripiri can be dealt with by skimming with an adze and burning, but this method is, of course, not practicable where large quantities are growing. Another method of keeping piripiri in check is to graze the infested land with horses, which are inclined to eat the weed quite readily. Stocking with cattle has the effect of trampling it out to a considerable extent. Cultivation, where it can be carried out, is the only really effective means of destroying the weed.

Unidentified Journal *Subscription.*—A letter without signature has been received containing two postal notes for 2s. each, Nos. 729501 and 697990, issued at Napier Post-office. The sender should communicate with the Publisher.

WORK FOR THE COMING MONTH.

THE ORCHARD.

It is interesting to note that an order has been recently issued by the Ministry of Agriculture in England imposing conditions on all plants imported into England and Wales. Under the definition of "plant" is included, among other things, fruit. This is of particular moment to those concerned in the fruit-export trade of this country, and may be taken as an indication that the authorities are no longer going to allow indiscriminate importations into Britain, irrespective of whether the shipments are clean or affected with disease. It would appear that all fruit going forward in future will have to be accompanied by a certificate from a duly authorized official of the country from which it is exported to the effect that it has been duly inspected and found to be free from the injurious insects and pests scheduled.

Matters relating to export conditions at this end for next season's fruit are to be discussed during the present month by the export committee set up at the recent Fruitgrowers' Conference, in conjunction with officers of the Department, after which it is hoped that a definite pronouncement regarding some of the minor details at present in course of settlement may be made. This committee will no doubt consider itself fortunate in having an opportunity of considering the English import regulations above referred to, as it is very probable that some of the conditions applying will have a considerable bearing on the position in New Zealand.

—*J. A. Campbell, Director of the Horticulture Division.*

AUCKLAND.

Growers should keep a careful lookout for fireblight in their orchards. Infected portions should be immediately removed, and the tools used in doing so thoroughly sterilized. Fireblight infection should be immediately notified to the Fireblight Committee established at Auckland, or to the local Orchard Instructor. Visits by those experienced should be made to neighbouring orchards whenever opportunity arises, and the first appearance of fireblight reported to those concerned.

Spraying: The chief operations will be those for the control of eating-insects, and also for brown-rot of stone-fruits and black-spot of pip-fruits. The spraying programme for the month may be summarized as follows: Apple, pear, and quince—Bordeaux, 3–4–40, when fruit sets; bordeaux, 2–3–40, or commercial lime-sulphur, 1–100 (33° Beaumé), three weeks later, in combination with arsenate of lead, 1½ lb. paste or ¾ lb. powder to 50 gallons water. Peach, nectarine, and plum—Commercial lime-sulphur, 1–125, or self-boiled lime-sulphur, 8–8–50, one month after fruit-set. Citrus fruits—Bordeaux, 4–4–40, when blossom-petals fall during the spring flowering, followed by red oil, 1–40, about fourteen days after.

Citrus-growers are advised where frosts have affected the growth, killing it back, to cut away all frosted parts to a bud. Failure to do this may bring on gummosis, and leave effective opportunities for the entry of borer.

Ploughing operations must now be completed, followed by the very necessary undertaking of working down the soil into a good tilth, before the dry weather sets in.

Thinning is a most important operation, and as soon as it can be seen that the fruit is properly set this work should be carried out on apples and pears. With stone-fruit it is necessary to wait until after stoning.

The disbudding of young trees (two or three years old) must be attended to, rubbing out the buds low down on the trunk, and leaving only sufficient buds for the formation of the main arms of the tree.

—*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

Continued attention should be given to cultivation, working the soil as often as is necessary to maintain a fine tilth. Young trees should be looked over, and superfluous growths removed while quite young. During the latter part of the month a start may be made with stone-fruit thinning.

Spraying operations for the month: Apple and quince—Arsenate of lead, 1½ lb. paste or 1 lb. powder, plus ½ gallon lime-sulphur, and the milk made from 1 lb. fresh slaked lime to each 50 gallons of water. When powdery mildew is expected, 3 lb. atomic sulphur may be added to this mixture. Apply as a calyx-spray, and again after twenty-one days. Pears—As for apples, except that 5 pints of lime-sulphur may be used instead of ½ gallon. Both apples and pears should be watched for red mite, and frequent applications of lime-sulphur, 1–100, given as they hatch. Stone-fruits—Lime-sulphur, 1–125, if required for brown-rot, and arsenate of lead for leach on plums.

—*W. H. Rice, Orchard Instructor, Hastings.*

NELSON.

Orchard summer sprays vary considerably to suit localities and different varieties of fruit as well as general weather conditions. Lime-sulphur (33° Beaumé), 1–120, is the standard summer spray here for all classes of fruit-trees; under difficult circumstances it is sometimes applied at intervals of ten days, and under easier conditions the interval may be lengthened to fourteen or twenty-one days. For pip-fruits arsenate of lead should be added. A sharp lookout should be kept for leaf-hopper and black or green aphis, and a nicotine spray applied at the first sign of infection.

As the month of November advances and the weather settles, a careful cross-ploughing will be of great advantage to many orchards, especially those on the heavier land. Plough only moderately deep, and harrow down immediately. These operations should on no account be carried out while the land or weather is wet.

When growth has attained a length of 5 in. or 6 in. young trees will require attention. The more vigorous growths that are not required for framing the tree should be stopped by pinching out the leading bud. Thin the crop on bearing trees where necessary, taking special care to strip the fruit from the tops of leaders for a foot or two. In this district trees inclined to be stunted from over-bearing, and strawberries and other plants commencing to crop, benefit greatly from an application of nitrate of soda at the rate of 1 lb. or 2 lb. about the roots of a tree or 1 cwt. or 2 cwt. to the acre. Examine grafts lately worked, and rewax them where necessary.

—*W. C. Hyde, Orchard Instructor, Nelson.*

NELSON CENTRAL.

When these notes appear most pears will be set. At that time the trees should receive another application of bordeaux at 3-4-40, or of lime-sulphur, 1–80. Winter Cole and Keiffer's Hybrid pears are not susceptible to black-spot in most localities. Apples will be at the petal-fall and fruit-setting stages, and the young fruits will need protection. Do not be lulled into security by the thought, "Dry weather, no spot," but keep the pump going; the aim should be to keep the trees sprayed about once every fortnight, or at shorter intervals if possible, if spot is discernible, using lime-sulphur, 1–100. Arsenate of lead will need to be added when the fruit is well formed for control of codlin-moth and leaf-roller. Do not wait till the grubs appear: aim to prevent their appearance. Bear in mind the possible danger of scorching when using combination sprays, and add lime-water or atomic sulphur to lime-sulphur as a preventive. In this connection last month's notes may be referred to.

Red mite is now hatching, and for this reason also the lime-sulphur spray should be kept going at short intervals. The addition of a little Black Leaf 40 for woolly aphis is advisable. Pear-mite is prevalent already, but very little can be done against this disease during the growing season. The trees should, however, be marked for treatment during the dormant period. During November mussel scale and San Jose scale will be moving. There are a few isolated cases of scale in this district, and to prevent its spread special attention should be given in case winter treatment has not been successful.

As soon as convenient remove the setting fruit from last season's leaders and from stunted and young trees. Give a little time and care to newly grafted trees by removing all surplus shoots from the stocks except those needed to replace possible misses.

—*J. H. Thorp, Orchard Instructor, Mapua.*

MOTUEKA.

Cultivation of the orchard should be attended to and the soil kept in good tilth. Thinning the crop should be undertaken where the fruit has set. This operation is of especial benefit to stone-fruit crops where the setting is heavy. The removal of malformed and diseased fruits on apples and pears is also advised.

Spraying measures will consist of the application of lime-sulphur, at 1–125 on stone-fruits and 1–100 on apples, about every three weeks, with addition of arsenate of lead, 3 lb. paste or 1½ lb. powder to 100 gallons, on the apples. An addition of Black Leaf 40, 1–1,000 should also be made where mealy bug or leaf-hopper appears. Spray pears with bordeaux, 3–4–40, adding arsenate of lead as for apples. Immediately pear-slug appears upon plum or cherry trees an application of hellebore or arsenate of lead should be made—the former for preference—on these fruits. Citrus-fruit trees affected with scale should be sprayed with red oil, 1–50. —*W. T. Goodwin, Orchard Instructor, Motueka.*

CANTERBURY.

Cultivation: Orchards should be kept thoroughly cultivated. After each rain the ground should be well worked, so as to prevent excessive evaporation and to conserve as much moisture as possible.

Disbudding: Trees planted this winter will now be starting into growth. They should be carefully gone over, and shoots which are competing with the leaders but are too badly situated to become framework branches should be stopped. Do not allow suckers to grow on the stock of reworked trees.

Thinning stone-fruits: This season the majority of stone-fruit trees are showing promise of a heavy setting of fruit. The work of thinning should be done as soon as possible after the pits harden. If this important orchard practice is neglected the percentage of cull fruit will be large. Remove all fruit from the tops of the leaders.

Spraying: Spraying for the month will be as follows: Codlin-moth—Arsenate of lead, 3 lb. paste or 1½ lb. powder to 100 gallons of water. Apple leaf-hopper—Lime-sulphur, 1–100, as soon as nymph form makes its appearance, to be repeated at intervals of ten to fourteen days. Red mite—Lime-sulphur, 1–100, at intervals of ten to fourteen days. Black-spot—Lime-sulphur, 1–100. Powdery mildew—Atomic sulphur, 1 lb. in 100 gallons; or sulphur atoms, 1 lb. in 9 gallons; or lime-sulphur, 1–100. All infected shoots should be removed and destroyed as they appear. Brown-rot, bladder-plum, peach-curl, and aphis on stone-fruits—Apply lime-sulphur, 1–125, at intervals of ten to fourteen days.

—*W. K. Dallas, Orchard Instructor, Christchurch.*

OTAGO.

Most varieties of apples will now be past the blossoming-stage. Lime-sulphur, 1–100, should be applied when the blossoms have fallen, repeating about three weeks later. Pears will now be setting their fruit. For prevention of black-spot spray with bordeaux, 3–4–40, when the fruit has set. If the weather is damp repeat at short intervals. Apple-trees just coming into bearing sometimes have a habit of fruiting on the leading shoots; this is especially the case with Jonathans. If the fruit is allowed to remain the leaders become weak and misshapen. Remove all blossom or fruit as early as possible.

Growers of stone-fruits are especially directed to give full attention to maintaining their sprayings for control of brown-rot. Apply lime-sulphur, 1–120, when the fruit has set, and again one month later.

—*B. G. Goodwin, Orchard Instructor, Dunedin.*

POULTRY KEEPING.

F. C. BROWN, Chief Poultry Instructor.

CARE OF THE YOUNG AND ADULT STOCK.

THE end of the current season for hatching chickens is now at hand, so that the heaviest stock of the year is being carried. Thus in the work of management the poultryman's time will be taxed to the utmost to ensure good results from both the adult and developing stock. Overcrowding, particularly as regards the growing birds, must be sedulously guarded against, otherwise the stock will seriously suffer. Indeed, making the quarters comfortable and the prevention of overcrowding are two of the most important items in the work of management at the present time. It is a better policy to cull out some of the adult birds which show evidence of possessing a weakened constitution and poor egg-capacity than to make the buildings carry more than they are built to accommodate.

Cleanliness is another important matter that must not be overlooked in the warm season of the year, or vermin will soon give trouble, especially with growing

birds. Even at this busy time cleansing and disinfecting operations must be vigorously pursued. It is only by these means and providing good dust-baths that insect pests can be kept at bay.

Particular attention should be directed to the feeding of the young pullets. The aim should be to keep the birds steadily growing without forcing them to prematurity. This condition may be prevented to a great extent by the elimination of rich foods, such as milk, meat, &c., from the ration. Chickens, after they leave the brooder, should have at least three good meals a day. The morning and midday meals should consist of a mash of pollard, bran, wheatmeal, ground maize, &c.; the evening meal should be of broken grains—wheat, maize, or good plump oats. Oats, especially when shelled, form an ideal food for the growing bird. Green food is especially necessary during hot weather, and cannot be oversupplied. Wherever possible give the young stock a good range, as confined conditions are not conducive to a healthy development.

In addition to giving the growing birds the best of care and attention the adult stock must be maintained in a productive condition. The hens that are to be culled next autumn should have a liberal supply of forcing food, such as meat-meal, &c., in order that every available egg may be secured before the birds are disposed of. Of course, when frequent cases of ovarian trouble are being experienced a reduction in the meat ration should be made.

Among other factors that must not be neglected now is the making of ample provision for autumn and winter green food. This will not only tend towards the maintenance of a healthy flock, but also reduce the grain bill.

LEG TROUBLE IN THE BROODER.

Many inquiries have reached me of late regarding chickens losing the power of their legs during the brooder stage. This is usually found in brooders where the conditions are unsuitable, especially where insufficient warmth is provided. Discomfort induces the chickens to huddle in corners, and their movement causes the bedding-material to work away from them, with the result that in their endeavour to secure an inside position, which is necessarily the warmest, the delicate legs spread, and the chickens become unable to walk. This trouble is intensified when the floor of the brooder is made of smooth boards, as the constant slipping on these soon injures the legs. Once chickens become so affected there is practically no cure, and in most cases it will be better to destroy them than to try and doctor them. Removing the cause of the trouble is the only safe course to adopt. The first step in this connection is to supply the desired warmth in order that the chickens be made comfortable and may spread out over the floor of the brooder.

A further preventive of this trouble, especially where a fireless brooder is being used, is to first cover the floor of the brooder with a thin layer of straw-chaff—say, ½ in. deep. On this place a single piece of sacking, the full size of the brooder-box, and cover with chaff or other bedding-material to a depth of about 2 in. By the adoption of this method a good foothold is provided for the chickens, so that in the event of huddling the risk of the legs spreading is reduced.

DUCK-REARING.

Where ducks are kept their eggs should now be set without delay for the production of the future laying-flock. If incubators are used the temperature to be maintained is 102° for the first week, and 103° for the remainder of the incubation period. It is a good plan to spray the eggs with water at a temperature of 103° every morning after the fourteenth day. This may be applied by means of the mouth or a fine florist's spray. Immediately the eggs are taken out of the machine they should be quickly turned, sprayed, and replaced in the incubator. Never cool after spraying. Spray in the morning, and cool at night. The period of incubation for duck-eggs is twenty-eight days, but they commence to pip on the twenty-sixth day. Thus the novice must be careful not to try and help the young birds out of the shell until they have been given their full time to hatch out.

Ducklings are much easier to rear in brooders than are chickens. Indeed, they require very little brooding after the first week, especially at this season of the year. Fireless brooders are most suitable for rearing ducklings. Care must be taken that the brooder is arranged in such a way that ample fresh air is available to them at all times. Neglect in this respect is apt to cause heavy mortality.

Do not feed the young birds for the first twenty-four to thirty-six hours after hatching. For the first few days give equal parts of bran and pollard, mixed with a small quantity of oatmeal and 5 per cent. of fine grit, the whole to

be moistened to the desired consistency with skim-milk or hot water. After the first week finely cut green food, such as lettuce, young succulent grass, oats, watercress, &c., must be fed daily. When the ducklings are about ten days old 5 per cent. of minced boiled meat should be added to the mashed mixture, and this proportion should be increased up to 10 per cent. as the ducks develop.

During the brooder stage ducklings should have drinking-water available to them at all times, both night and day. If after a long fast water is supplied, and especially before the birds have been given a meal, fatal results are almost sure to follow. The affected ducklings will be observed to stagger and fall on their backs, and will constantly endeavour to look backwards. Ducklings which have been affected by sunstroke will behave in a similar manner; thus good shade is an essential at this time of the year. Never allow ducklings to sleep on damp or wet bedding, as this is a common cause of leg-weakness during the brooder stage. The drinking-water should be placed well away from the sleeping-quarters so as to prevent the bedding-material from becoming wet. As a further means to this end the water-vessel should be placed on a wooden frame a few inches high, and covered with small-mesh wire netting, under which a dish should be placed. The latter will catch any droppings, and greatly tend towards keeping the sleeping-quarters in a dry state. See that the drinking-vessels are sufficiently deep to enable the ducklings to give their nostrils a good clean out; if the latter are allowed to clog, the eyes become plastered and the bird soon presents an unhealthy appearance.

The ducklings now hatched and being reared for the Christmas market must be fed and managed to the best advantage if the maximum price is to be secured for them. A good fattening-diet consists of equal parts of maize-meal, pollard, and bran well moistened with skim-milk, while in addition a large amount of skim-milk should be given to the birds to drink. Feed at least three times a day as much as the birds will eat without waste. Ducklings should be fed from troughs; if the food is thrown on the ground a large part of it will be wasted, while the runs will become tainted owing to the wasted food turning sour.

THE APIARY.

F. A. JACOBSEN, Apiary Instructor.

As these notes are written some time before they are intended for practical application, allowance for variable climatic conditions must be made in reading them. They apply to an average season.

ARTIFICIAL INCREASE AND SWARMING.

The commercial bee-master regulates his colonies to prevent swarming, and thus secures the maximum honey crop possible. Where increase in the number of colonies is desired he makes the increase himself without waiting for the bees to swarm under natural conditions. He regulates the colonies according to his requirements, and the novice, to get the most profit, must do the same. Swarming is one of the most difficult things to contend with, and elaborate precautions are adopted for control; so much is gained by preventive measures, however, that the labour involved is well repaid. Artificial increase assists materially in swarm-control. Early queens must be reared or swarm-cells secured for the purpose. The stronger colonies are then divided by taking nearly all the brood contained in the frames, with adhering bees, and placing it in a fresh hive in a new location. This hive may be closed for about twenty-four hours to prevent too many bees flying back to the old stand. The old queen is left in the hive on the first location, while the new queen or queen-cell is introduced to the new hive. Two colonies are thus made from one, and it is surprising how rapidly each will build up to normal strength. The old colony, having been deprived of the majority of its brood, will relinquish the desire to swarm, and will concentrate on further brood-rearing and on honey-gathering.

After-swarms: Where preventive measures, which are not always entirely successful, have failed, and a colony has swarmed, any further issues must be prevented if the owner desires a honey crop. Several swarms from one colony would weaken it to such an extent that it is doubtful whether the reduced numbers would gather sufficient supplies to keep themselves alive through the following winter. The first or prime swarm will issue about eight or nine days after the laying of the egg, and at this time the first queen-cell is capped over by the bees. After a further eight days, or thereabouts, the virgin queen is due to

hatch, so that it takes sixteen days from the laying of the egg before a fully matured queen emerges from the cell. The first swarm is headed by the old queen, and the colony is left queenless for several days. To prevent after-swarming, which will usually occur if the colony is in a strong condition, all queen-cells but the largest and best-shaped must be destroyed. This should be done the day following the issue of the swarm; and, further, another examination must be made several days later, and any more queen-cells which have been started removed.

Returning prime swarm: When no increase is desired the prime swarm should be returned to the parent colony after all queen-cells have been removed. A super should be added, and some of the brood combs from below placed in the centre with foundation, or drawn combs for preference, on either side. Furthermore, if the entrance is small, an enlargement should be made to supply additional ventilation. These factors have a direct bearing on the subsequent control of the swarming impulse.

Hiving swarms: After a flight in the air for several minutes the swarm will generally settle on some bush near at hand. A shower of water over them from a spray-pump will tend to induce their settling. When it is seen that they intend to settle, one of the hives prepared for such occasions should be placed on the spot it is to occupy. An empty super is then placed over the frames in the lower story, which should contain clean-drawn combs or full sheets of foundation. When the swarm has settled on the slender limb of a tree the latter may be snipped off above the bees, and the whole carried to the prepared hive. The bees, limb and all, are then placed in the empty super and the cover is put on. In the evening the bees will be found on the frames below, and the super may be removed. It does not always happen, however, that the swarm is in such an accessible position as that indicated, and sometimes it is extremely difficult to hive them. When it is not desirable to cut the branch on which the bees have settled, or when delay in hiving is necessary, they should be covered with a sheet as a protection from the rays of the sun. This will also prevent them escaping. A box is next procured, and the swarm shaken or brushed into it, the box then being placed on the ground, mouth downwards, and an entrance left for the bees. Towards evening, when all have clustered in the box, the bees may be dumped into the prepared hive on the permanent location, and the mat and cover placed in position. Should the parent colony be suspected of harbouring foul-brood, the swarm may be freed from the disease by leaving it in the box for four days before transferring it to the permanent hive.

EXTENDING THE COLONY.

The novice with a few colonies is frequently neglectful of their welfare, and incidentally of his own. Should supers with frames of foundation or drawn comb not already have been added to the brood-chamber, it is now time to do so if swarming is to be prevented. Further supers should be added as required, care being taken to do so before those already on the hives are quite filled. Did the average farmer appreciate the possibilities in beekeeping as a side-line, he or his womenfolk could, by the exercise of a little care and thought, make it a good source of revenue.

VITICULTURE.

J. C. WOODFIN, Vine and Wine Instructor.

THE VINEHOUSE.

THERE are found to be a good many variations in the manner of planting and training grape-vines, a number of which are not in accordance with orthodox methods. In some cases the variation is inadvertent, in others intentional. Those who grow for market prefer comparatively small bunches, these being easier to weigh out. This is accomplished either by leaving two or more bunches on each lateral, or by having the rods closer together than is usual in the case of private growers. The latter may be effected either by duplicating rods or by close planting. The general rule is to retain only one lateral to each spur, but some growers retain two, and, of course, crop both. This is only possible where the vines are kept well down from the glass and the rods a fair distance apart. In these notes general principles only can be dealt with, and the methods recommended are those suitable for ordinary growers; experts know how to vary the usual practice to suit their own requirements.

It has already been stated that the laterals should be stopped two leaves beyond the bunch of fruit to be retained. It seems necessary to say that this rule is not invariable. Thus it may be advisable to stop at one leaf beyond the bunch, as is the case when the rods are less than 3 ft. apart. Subsequent breaks are stopped beyond the first leaf in every case. Other breaks, termed "sublaterals," occur from the sides of the laterals and grow up towards the glass. It is important that there be room for a free current of air to pass between the canopy of foliage and the glass. The main leaves are those of greatest value; possibly those on sublaterals may have little or no value. In any case the latter must not be allowed to choke the space between the vines and the glass, or to shade the main leaves to any extent. The sublaterals should therefore be stopped beyond the first leaf, or, if they tend to crowd, be removed altogether. The sublaterals immediately above a bunch of fruit and those nearer the ends of the laterals are of greater value than those occurring between the bunch and the rod. The one that occurs close to the junction of rod and lateral should be saved.

THE VINEYARD.

At this period it is advisable to undertake control measures for powdery mildew or oidium, one of the most troublesome of grape-vine diseases. It affects the green and tender foliage and fruit. The young leaves show whitish or greenish-white patches on the upper and lower surfaces, a mottled appearance being thus produced. Later, these patches run together until a large portion of the leaf is covered with what appears to the naked eye to be a whitish powder; hence its name. Eventually black pimple-like fruit-bodies of the fungus are seen scattered over the affected area. The diseased foliage has a wilted and dwarfed appearance, and the skin of the grapes becomes hardened, in severe cases causing the berries to burst and dry up. Powdery mildew winters in the buds, and if it develops early assisted by moist weather, which is favourable to its growth, may prevent the blossoms from setting. Grapes which have been attacked by powdery mildew, if used for wine, give it a disagreeable mouldy taste and diminish its keeping-qualities.

Winter treatment which is effective for the prevention of black-spot is useless when applied for oidium. Sulphur is the best remedy, and is applied in a dry form by means of sulphur-bellows, or, where a large number of vines is to be treated, with a Vermorel sulphurator. The sulphur should be as fine as possible; precipitated sulphur is therefore preferable to ground or sublimed sulphur. Good results are also obtained with atomic-sulphur spray at the rate of 12 lb. to 100 gallons. The best time to apply sulphur to the vines is in calm weather, preferably in the morning when the dew is still on the leaves. The presence of dew is not essential, though it causes the sulphur to adhere better. The fungicidal properties of sulphur reside in the fumes given off when the temperature rises above 70° F. It has been noticed that sulphur-dusted vines show less tendency to drop their blossoms, and also ripen their fruit seven to ten days earlier than they otherwise would. The sulphur should be applied soon after the first leaves open, again during or just after blossoming, and again a fortnight later. Further applications are sometimes necessary on very susceptible varieties.

Where it is necessary to treat for black-spot, summer-strength bordeaux will be found suitable for powdery mildew also. Liquid fungicides, however, are not as effective as sulphur-dust, and in vineyards where this disease is particularly troublesome together with other diseases it is better to follow bordeaux spraying with sulphur-dust.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

The Gourd Family.

THIS family includes the different species and varieties of melon, pumpkin, marrow, cucumber, and other plants that produce fruit of a similar character. All are tropical plants, but differ somewhat as regards the amount of heat they require. Pumpkins and marrows are the hardiest, and can be grown in any part of the Dominion; hardy varieties of cucumbers, known as ridge varieties, come next: pie-melons can be grown in most places with more or less success; while water-melons, cantaloupes, and rock-melons succeed only in the warmer districts. One of the secrets of success is not to start until outside conditions are such as will

ensure a continuous vigorous growth without check. A feature of most of our warm districts is the occurrence of late spring frosts, and it is useless to start until these are practically past. In other places the soil is not really warm until spring is nearly past. The first week in November is the best time to commence work in the open ground.

A start may be made by planting seeds, or by putting out plants raised under glass. A good many growers raise plants with makeshift contrivances, such as a box placed in a warm situation; others plant the seeds earlier and protect them in some way. Such methods are mistaken ones, as the plants so started are not vigorous at the beginning, and the early start is lost in the time it takes the plants to get accustomed to their new situation when planted out. It is logical to assume that there is an advantage in setting out plants in place of seeds, seeing that it can be done at the same time. To secure this advantage, however, it is necessary that the plants should have been properly raised and hardened, and also that they have had time to make a fair quantity of roots. There is necessarily some check in transplanting, and a little time is lost while the roots are getting hold of the soil. During this period the plants are very liable to injury by wind, and some precaution is necessary to prevent this. Two or three pieces of stick so placed as to prevent movement of the plant by wind are very effective. Unless these points are observed and great care taken the advantages of setting out plants are lost. Where the plantation is large, seeding is the only practicable method.

Some correspondents, writing from warm districts, state that water-melons fail to ripen before autumn frosts set in. In explaining this it is necessary to consider the habit of growth and how the fruit is borne; in this respect all plants of the Cucurbitaceæ are the same. Long main branches, commonly termed "runners," are made, and on these are shorter lateral growths, which are the chief source of fruit, although the runners will also bear. It is a common occurrence for pumpkins, &c., to show blossoms and set fruit on the first runners, but usually such fruits die off after getting about the size of a hen's egg. If such a plant is left alone it will later on produce fruit quite freely. This is recognized by farmers and others who grow acres of pumpkins, to whom early fruit is of no consequence.

In small cultivations, where part of the crop is required at an early date, different methods are necessary. The first strong runners are checked by having the ends cut off, and similar checking is done from time to time as fresh runners get away. Stopping the runners forces the growth of laterals, which are the proper fruit-bearers, causing them to produce fruit earlier than would be the case on unchecked plants, and also in greater numbers. In the case of water-melons, particularly where autumn frosts occur, this practice should be adopted. In this case the fruit must be thoroughly ripe, and endeavour should be made to get the earliest fruits to set so as to allow time for ripening. This may be assisted by cutting off any extensive later growths, though these are not likely to occur if a fair crop is started at the proper time, as the latter would check further strong growth until the autumn rains.

With regard to the class of soil suitable for gourds in general, it may be stated that a fair amount of humus is beneficial, but any fairly good and holding soil will grow good crops. If artificial manure is required, blood-and-bone with a little sulphate of potash will answer. It is not required, however, where the soil is good and has not been worked out. It is not easy to reconcile opinions and practice in this matter, but there is no doubt that excellent crops can be grown on a heap of garden weeds and rubbish by merely throwing on a few shovelfuls of soil to plant the seeds in, and giving no other attention than the stopping of runners and, if large specimens are wanted, the thinning of fruit. In field culture two or three plants in clumps 10 ft. apart will cover the space if stopping is practised, while if the runners are not stopped they will intermingle. When the humus content of the soil is not sufficient, holes may be dug where each clump is to be, a few forkfuls of half-rotted farmyard manure thrown in, and the soil replaced.

Tomatoes.

Planting-out can be done earlier in some places than in others, although the time for this operation does not greatly vary in the different districts. The same mistake is often made as with the gourds, many growers, even those growing for market, planting too early. On this point I might mention a plan tried in the Hutt Valley and one or two other tomato-growing centres. Kerosene-tins were cut in a special way to take a sheet of glass on the sunny side. The glass could be easily taken out on fine days and replaced at night or in bad weather. The arrangement answered its intended purpose in enabling earlier planting, but the plants were so weakened that they suffered when the protection had perforce to

be removed. The plan was abandoned after a year or two as doing more harm than good. A fact recognized by the most experienced growers is that earlier fruiting may not be secured by early planting; in fact, an opposite effect is often obtained. The most effective plan is not to plant until conditions are such as will ensure an immediate start into growth and continuance of this without check. The correct time to plant in most places is the first week in November. Other factors that make for success are properly prepared plants and assiduous attention to stopping, &c., after the plants begin to grow.

Miscellaneous.

All varieties of broccoli that have not already been sown should be got in during the first half of November. Plants should be ready to set out from the last week in December to the middle of January; if planted after that time only partial success may be expected. Cabbage-seed should in the warmer parts be sown about 25th November, with savoys at the same time. Planting should be finished before the end of January.

For the main crop of carrots, parsnips, and red beet sow during the first week in November. The soil is by this time warm, a good seeding-surface is easily secured, and slugs are not much trouble. Seed can therefore be sown as thinly as is possible, as there should be practically no losses. Thin seeding results in time saved in thinning the seedlings, which are also sturdier and make better plants than when crowded in the lines.

Thinning seed rows of onions should have been finished before now, and weeds should be kept under control by frequent cultivation. Cultivation, whether by hand-hoe or other implement, should be as shallow as possible; the purpose is to suppress weed-growth, which would rob the soil of moisture, and to create a dust mulch to prevent evaporation of moisture by sun and wind. The hoe should not penetrate much more than 1 in., or at most 2 in. Small bulbs for pickling can be secured by sowing Silverskin during the last half of November. Select a plot of poorish soil; make it as firm as possible by treading or rolling; sow seed rather thickly; and do not thin. Seeds may be broadcasted if there is no danger of weeds choking the young plants, otherwise sow in broad drills. Sow turnip in small breadth, sow and plant lettuce, and sow peas and French beans as succession crops.

The cutting of asparagus should cease as soon as peas come into use. Next year's crop depends on the amount of top-growth left to die down. Beds that were planted this or last year require care. No heads should be taken from beds till the third year from planting, and only a limited number in that year; which means that cutting should continue only for a short time. Care is necessary to prevent loss of plants by wind, and it may be necessary to protect them by means of stakes and lines of binder-twine. Very often it is sufficient to pinch the tips out of the heads before they become tall; this will cause them to branch and remain more dwarfed. The soil should be kept loose, and when this state is preserved fine particles will drift down into the spaces caused by the stems waving in the wind; this automatic filling of the holes will do much to save the tops.

STOCK SLAUGHTERED, 1920–21.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary slaughterhouses throughout the Dominion during the year ended 31st March, 1921:—

—	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughterhouses.	Totals.
Cattle ..	111,274	194,089	..	61,202	366,565
Calves ..	21,896	6,525	..	1,887	30,308
Sheep ..	666,196	3,671,182	..	278,142	4,615,520
Lambs ..	104,134	3,433,101	..	26,735	3,563,970
Swine ..	64,002	40,590	25,895	13,189	143,676

In addition to the above, 26,024 pigs killed and dressed by farmers were inspected at butchers' shops.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BLOOD IN THE MILK.

B. AND B., Haumoana :—

Several newly calved cows are giving a reddish fluid from certain quarters, evidently owing to blood colouring the milk. There is no sign of inflammation or hardness, and the cows do not appear to suffer discomfort. Should this trouble be treated ?

The Live-stock Division :—

The condition you mention is not an uncommon one in newly calved and young cows. They should be "stripped" as carefully as possible so that the blood-vessels are not further injured. It is not a bad plan to give a moderately large dose of Epsom salts, and to give for a few days afterwards ½ oz. doses of saltpetre.

SEA-SHELL LIME AND CRUSHED LIMESTONE.

A. L. SMITH, Tauranga :—

Would you recommend the use of crushed sea-shell lime in place of crushed limestone ? The former is prepared here, and is somewhat cheaper than crushed limestone. Would the sea-shell lime have such a high test as limestone ?

The Agricultural Instruction Branch :—

In regard to the use of crushed sea-shell lime, we presume that you refer to the lime prepared by the Farmers' Lime Company, Tauranga, the sample of which submitted to the Department showed on analysis 89 per cent. of carbonate of lime. The sample was finely ground, and would be suitable for such a climate as that of the Bay of Plenty and Tauranga, which have a well-distributed and adequate rainfall. Comparing crushed sea-shell lime with crushed limestone, the percentage of carbonate in each should be determined, and if this figure is divided into the price quoted you will have the unit price in each case. This will indicate which is the cheaper material. Of course, the finer the grinding the greater the surface exposed, and when the material is put into the soil the more finely it is ground the quicker it will become available.

FIG-TREE WITH NON-MATURING FRUIT.

"SUBURBAN," Devonport, Auckland :—

I have a five-year-old fig-tree (Turkey Red) which grows healthily, but fruits so late that the fruits do not mature. Could this be remedied ?

The Horticulture Division :—

There is no apparent reason why figs should not ripen at your place, as they do very well in the same neighbourhood. The presumption is that you have not got the right variety. There are several races or families of figs with numerous varieties in each family. Some of them will not ripen fruit unless they are fertilized, which must be effected by a certain wasp which is not present in New Zealand. The following are some of the varieties that will ripen fruit without being fertilized : Brown Turkey, Black Ischia, Malta, Black Genoa, and White Adriatic. You should succeed with any of these varieties. The Turkey Red you are growing probably purports to be Brown Turkey, but may not be true to name.

GREEN CEREALS AND RAPE FOR LAMB-FATTENING.

"INQUIRER," Eketahuna :—

Kindly let me know if Cape barley or rye-corn would be suitable for growing with rape, or recommend a suitable quick-growing crop to combine with rape for lamb-fattening.

The Agricultural Instruction Branch :—

Rye-corn has a fairly low feeding-value, and we do not therefore advise its sowing with rape for the purpose of fattening lambs. Either Algerian oats or Cape barley might be so used, however, the seeding per acre being 1 bushel with 1¼ lb. of rape in either case. Rape may be sown in October when used alone, but a little earlier when a nurse crop such as oats or barley is sown with it.

GAS-LIME FOR BLACKBERRY-CONTROL.

"SUBSCRIBER," Tangowahine :—

Please tell me whether gas-lime is effective for killing small patches of blackberry, and, if so, advise particulars.

The Live-stock Division :—

The effect of gas-lime on blackberry is only temporary—it only destroys the young surface shoots, and not the roots. When used for this purpose it should be applied during the months of October and November by dusting it on to the shoots. Stock should not be allowed access for at least fourteen days after the gas-lime has been applied.

PEAS FOR COW-FEED.

"INQUIRER," Okete :—

Will you please advise me as to the best peas to grow for cow-feed, and also state the method of cultivation, the quantity sown per acre, whether drilled or sown broadcast every few weeks, and the best time to cut them.

The Agricultural Instruction Branch :—

It is not advisable to feed peas to cows in the green state, nor in the dry state until the crop is threshed, when the stock can be fed on pea-straw, together with mangolds or any other root crop. The land should be cultivated in a manner similar to that employed when preparing for potatoes or mangolds. During the month of October, drill through every coulter, in 7 in. drills, 2½ bushels of Blue Imperial or Prussian Blue peas to the acre. The best time to cut the crop is during the process of ripening, which must be watched very closely or the results will not be satisfactory.

WOODLICE IN HIVES.

J. R. S., Gisborne :—

I should be glad if you could inform me as to how slaters (woodlice) may be kept out of hives and from destroying foundations. Every winter my hives are badly infested, generally the bottom box.

The Horticulture Division :—

Keep the ground surrounding the hives free from boards, rubbish, long grass, &c., or any other thing likely to harbour the woodlice, and disturb them in the hives as often as possible. At night-time they may be killed with boiling water with a little permanganate of potash added. Generally speaking, by keeping the hives and surrounding ground clean, these insects are prevented from becoming troublesome.

GROWING CHOU MOELLIER.

JAMES PEARCE, Washdyke, Canterbury :—

I am desirous of trying chou moellier as a feed for cows, and would be glad to be informed if the seed could be sown through the seed-drill with a fertilizer as in the case of turnips, and, if so, the seeding and fertilizer required.

The Agricultural Instruction Branch :—

Chou moellier responds well when grown on land that has received a good application of farmyard manure. At time of sowing the addition of 1½ cwt. per acre of superphosphate, drilled in with the seed, gives good results. The quantity of seed required is about 1½ lb. per acre. Sow in rows 21 in. apart, and intercultivate during the early period of plant-growth. The seed can be sown through the turnip-attachment of any drill. Chou moellier stands transplanting well, and in this way any blanks in the rows can be filled up. The plants should not be overcrowded in the rows; a space of 18 in. between the plants will generally be found to be suitable.

LAMPAS IN HORSE.

"FARMER." Tataraimaka :—

Could you inform me if there is any remedy for lampas in a horse's mouth? As it is illegal to have them burnt out, I should be glad to know how they may be removed.

The Live-stock Division :—

(1.) Lampas, as a diseased condition of the horse's mouth, is largely an imaginary trouble, existing more frequently in the head of the horse-owner. Where there is some inflammatory condition of the mouth, as in stomatitis or as the result of teething, the hard palate may become swollen and the condition persist till the cause is removed. The only surgical means that should be adopted is the scarification of the swelling with a perfectly clean knife. Afterwards the horse should be supplied with plenty of clean water and be kept on a soft diet for a few days. Teaspoonful doses of nitrate of potash may be given in the drinking-water with advantage.

REMOVING OBSTRUCTION IN THROAT OF COW.

C. M. BIRKETT, Stratford :—

Could you give me any information as to how to treat and handle a cow having a turnip or other root stuck in her throat? Recently a neighbour lost a valuable cow by using a rubber tube to push the turnip down, the throat being so injured that the animal soon died.

The Live-stock Division :—

If the obstruction is still in the throat a gag should be put in the mouth, and while the head is held the hand should be inserted into the back of the mouth and the object withdrawn. If the turnip has got beyond this and is in the upper part of the gullet, an assistant should try and work it up into the back of the throat so that it can be reached and withdrawn. In all other cases attempts should be made by outside manipulation to get the obstruction to move either upwards or downwards, and to help this movement a little oil should be given to lubricate the tube. Where the object cannot be reached the proper instrument, a probang, should be passed slowly over the back of the throat and down the œsophagus till the offending body is reached, when gentle pressure should be applied. The probang should be oiled before being inserted and used gently and with a continuous pressure, and not like a pile-driver. The parts here are very delicate, and permanent injury or death often follows the improper use of this instrument.

TWIN CALVES AND BREEDING.

J. N. B., Otane :—

One of my heifers calved twins, a heifer and a bull, and I have been informed that in such a case the heifer calf subsequently proves useless for breeding purposes. Is this correct?

The Live-stock Division :—

When a bull and a heifer are born as twins it is generally accepted that the heifer will not breed. This, however, is not an absolute rule, as a few exceptions have been known. Twin heifers are not less likely to breed than any other heifers.

ANNUAL SHEEP RETURNS, 1921 (30TH APRIL).

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

——	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams	765	845	4,598	1,175	5,110	3,883	16,376
Other rams	23,702	78,312	67,671	16,819	67,159	52,105	305,768
Wethers	361,707	777,284	887,640	228,671	624,052	755,445	3,634,799
Breeding-ewes	888,998	2,908,223	2,515,235	703,058	2,896,291	2,235,983	12,147,788
Dry ewes	139,334	420,552	330,715	77,493	170,670	207,055	1,345,819
Lambs	487,441	1,520,499	1,360,802	410,839	1,032,778	1,622,122	5,834,481
Totals, 1921	1,901,947	5,705,715	5,166,661	1,438,055	4,796,060	4,276,593	23,285,031
Totals, 1920	1,870,178	5,914,680	5,381,892	1,330,824	5,013,658	4,408,738	23,919,970

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1912–21.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Flock Sheep, and Sheep of Distinctive Breeds not entered in Flock-books.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1912	306,588	232,782	11,563	155,498	706,431	3,359,969	12,044,247	1,324,200	6,315,306	23,750,153
1913	313,690	228,145	12,902	167,605	722,342	3,207,550	12,292,891	1,150,805	6,818,222	24,191,810
1914	321,869	229,055	13,526	170,169	734,619	3,211,661	12,691,121	1,152,749	7,008,613	24,798,763
1915	315,251	237,717	17,341	176,556	746,865	3,270,221	12,377,624	1,365,119	7,141,592	24,901,421
1916	316,131	252,201	15,012	175,155	758,499	3,478,263	12,640,566	1,189,023	6,721,799	24,788,150
1917	329,230	160,212	6,212	114,778	610,432	3,457,824	13,099,957	1,066,435	7,035,738	25,270,386
1918	325,111	171,437	6,297	125,116	627,961	3,696,520	12,850,597	1,592,452	7,770,772	26,538,302
1919	321,304	165,676	12,196	127,150	626,326	3,922,632	12,176,224	1,799,201	7,304,171	25,828,554
1920	306,621	154,516	9,803	109,454	580,394	3,901,742	11,415,159	1,814,391	6,208,284	23,919,970
1921	322,144	158,608	9,513	110,428	600,693	3,634,799	11,989,180	1,336,306	5,724,053	23,285,031

NOTE.—Stud sheep returned since 1917 are only those entered in Flock-books.

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS IN EACH SHEEP DISTRICT (1921).

—	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in Flock-book)—									
Merino	..	..	..	..	6,886	11,517	2,508	20,911	20,911
Lincoln	1,330	3,894	18,522	23,746	1,346	753	1,527	3,626	27,372
Romney	10,302	11,130	69,188	90,620	9,123	8,740	29,372	47,235	137,855
Border Leicester	384	..	432	816	240	9,269	11,751	21,260	22,076
English Leicester	507	548	386	1,441	1,358	24,723	1,050	27,131	28,572
Shropshire	90	..	441	531	56	1,437	311	1,804	2,335
Southdown	304	3 470	11,004	14,778	67	5,459	305	5,831	20,609
Corriedale	..	..	38	38	110	26,293	7,703	34,106	34,144
Other breeds	157	6	165	328	..	695	28	723	1,051
Totals	13,074	19,048	100,176	132,298	19,186	88,886	54,555	162,627	294,925
Sheep of a distinctive breed but not entered in Flock-book—									
Merino	1,644	6,991	6,644	15,279	175,911	360,122	230,898	766,931	782,210
Lincoln	13,298	99,662	74,836	187,796	5,686	8,844	5,813	20,343	208,139
Romney	222,175	946,977	844,696	2,013,848	152,922	91,354	339,333	583,609	2,597,457
Border Leicester	1,636	1,360	4,885	7,881	821	55,575	64,881	121,277	129,158
English Leicester	2,081	366	1,176	3,623	11,611	85,842	5,336	102,789	106,412
Shropshire	1,300	121	1,168	2,589	1,235	8,080	1,545	10,860	13,449
Southdown	671	7,517	18,931	27,119	275	10,244	206	10,725	37,844
Corriedale	781	12,188	25,832	38,801	7,035	294,602	226,214	527,851	566,652
Half-breds	..	..	..	..	213,204	623,248	274,220	1,110,672	1,110,672
Other breeds	380	567	375	1,322	25	7,507	7	7,539	8,861
Totals	243,966	1,075,749	978,543	2,298,258	568,725	1,545,418	1,148,453	3,262,596	5,560,854
Crossbreds and others not otherwise enumerated	1,644,907	4,610,918	4,087,942	10,343,767	850,144	3,161,756	3,073,585	7,085,485	17,429,252
Grand totals ..	1,901,947	5,705,715	5,166,661	12,774,323	1,438,055	4,796,060	4,276,593	10,510,708	23,285,031

IMPORTATION OF FERTILIZERS: SEPTEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 30th September, 1921, the name, quantity, and declared value of each kind, together with country of departure, being specified:—

Sulphate of Ammonia.—Australia, 23 tons, £379.

Gypsum.—Australia, 250 tons, £426.

Nitrate of Soda.—Australia, 35 tons, £924.

Basic Slag.—United Kingdom, 200 tons, £1,465; Belgium, 75 tons, £593; France, 50 tons, £302: total, 325 tons, £2,360.

Bonedust.—Australia, 135 tons, £1,565.

Char Dust and Bone Char.—Australia, 65 tons, £437.

Guano.—United Kingdom, 10 tons, £196; New Caledonia, 811 tons, £1,672: total, 821 tons, £1,868.

Rock Phosphate.—Australia, 445 tons, £1,712; Nauru, 1,851 tons, £3,765: total, 2,296 tons, £5,477.

Superphosphate.—Australia, 1,340 tons, £8,954.

Kainit.—France, 25 tons, £124; Germany, 135 tons, £625: total, 160 tons, £749.

Sulphate of Potash.—France, 20 tons, £552; Germany, 10 tons, £261; Netherlands, 50 tons, £1,181: total, 80 tons, £1,994.

Potash, other.—France, 65 tons, £449.

Sulphate of Iron.—United Kingdom, £1; Australia, £8: total, £9.

Other Fertilizers.—Australia, £3; United Kingdom, 1 ton, £17: total, 1 ton, £20.

NOTE.—With regard to the "declared values" which are given above, the Comptroller of Customs gives the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not nearly cover the present freight, insurance, and other charges, the statistical value is a long way less than the actual landed value."

CROP STATISTICS FOR SEASON 1920–21.

THE following complete returns have been issued by the Government Statistician:—

Crop.	Area.	Yield per Acre.	Total Yield.
Wheat—	Acres.		
For threshing ..	219,985	31·24 bushels ..	6,872,262 bushels.
For chaff, hay, or ensilage ..	1,623	1·53 tons ..	2,481 tons.
Oats—			
For threshing	147,559	35·41 bushels ..	5,225,115 bushels.
For chaff, hay, or ensilage ..	410,059	1·36 tons ..	557,023 tons.
Barley—			
For threshing	46,802	33·90 bushels ..	1,586,711 bushels.
For chaff, hay, or ensilage ..	670	1·81 tons ..	1,220 tons.
Maize—			
For threshing	11,514	43·50 bushels ..	500,845 bushels.
For ensilage	667	6·62 tons ..	4,418 tons.
Grasses and clovers—			
For seed—			
Rye-grass	56,471	357·79 lb. ..	20,310,154 lb.
Cocksfoot	17,527	155·46 lb. ..	2,724,816 lb.
Chewings fescue ..	3,469	196·06 lb. ..	680,116 lb.
Crested dogstail ..	3,879	185·88 lb. ..	722,337 lb.
Red clover and cow-grass	6,347	162·33 lb. ..	1,554,770 lb.
White clover	3,356	152·48 lb. ..	512,480 lb.
Other grasses and clovers	3,901	150·47 lb. ..	706,152 lb.
For hay or ensilage ..	162,820	1·68 tons ..	272,515 tons.
Peas and beans	14,466	24·54 bushels ..	355,295 bushels.
Linseed	9,663	0·47 tons ..	4,552 tons.
Potatoes	22,068	5·72 tons ..	126,648 tons.
Onions	630	7·82 tons ..	4,924 tons.

THE WORLD WOOL POSITION.

SHEEP FLOCKS GREATLY REDUCED.

THE following statement was made last month by the Hon. W. Nosworthy, Minister of Agriculture :—

"In the many reviews that have been made of the present wool position it does not appear that sufficient consideration has been given to the reduced number of sheep throughout the world. Much has been made of the carry-over stocks of Imperial Government wool which have obsessed the minds of producer, manufacturer, and consumer alike. When the worst is said the total stocks held by the Imperial Government at the end of December, 1920, amounted to something less than the equivalent of the 1919–20 Australia, New Zealand, and Cape clips. Is it not a fact that in normal times this quantity of wool, and perhaps more, would be held as a matter of course at the commencement of the marketing of a new clip by manufacturers in the United Kingdom, France, Belgium, and Germany? For once in the world's history this wool has been all in one hand, counted, and held up as a bogey before every one's eyes.

"Immediately after the war the world was starved for woollen goods, and the demand forced up the prices for both raw and manufactured goods to abnormal and unjustified prices. The orgy of spending had the natural ending of empty pockets, and the sudden cessation of demand, coupled with heavy working-costs, labour troubles, and the delay in determining the German reparations and the basis on which business would be done with late enemy Powers, resulted in a panic which brought prices down in a few months to the lowest this country has ever seen, and far below the cost of production.

"Comparison of the world's flocks of sheep in 1914 and 1920 indicates that every bale of the carry-over wool will be needed for consumption, and the increased activity lately evidenced in manufacturing centres justifies the belief that an upward movement in values, bearing at least some closer relation to the cost of production, is now in progress.

"The following figures are compiled from official statistics, and show the number of sheep in the principal countries producing wool with which New Zealand wool is in competition :—

	1914.	1920.
United Kingdom	27,886,095	25,107,806
United States	49,719,000	45,067,000
Canada	2,175,302	3,720,783
Argentine	83,546,000	45,309,419
Uruguay	26,286,296	*11,472,852
South Africa	35,710,843	29,305,241
Australia	78,600,334	73,002,250
New Zealand	24,798,763	23,919,970
Totals	328,722,633	256,905,321

* 1918 (latest figures available).

"There is no suggestion that the production of wool in 1914 was in excess of the world's requirements—rather the contrary, as wool rose gradually in price from 1906 to 1914. Yet it is seen that in 1920 there were in these eight countries 71,817,312 sheep fewer than in 1914, the annual reduced production of wool at 7 lb. per head and 350 lb. to the bale being no fewer than 1,436,346 bales.

"Of the principal Continental sheep-breeding countries the most reliable figures show that the flocks of France, Germany, Spain, and Italy combined have been reduced by over 10,000,000 sheep. Of Austria, Russia, and Turkey there are no late statistics, but even if the usual quantities were available from these countries, which is impossible, the wool does not come into competition with the wool of the dominions.

"Careful consideration of the above facts will, it is hoped, assist to produce a more hopeful financial outlook for our sorely embarrassed wool-growers."

USE OF DELETERIOUS MATERIALS IN SHEEP-MARKING.

THE following resolution, adopted by the Association of British Chambers of Commerce at its annual meeting held in London in June last, has been transmitted to the Government by the High Commissioner, and is commended to the attention of those concerned as supporting similar advice frequently given by the Department :—

"That in view of the great loss and expense incurred by all manufacturers of woollen goods owing to the presence of tar, pitch, paint, &c., in the raw wool, and also the amount of faulty manufactured goods resulting from the same cause, this meeting urges the Council of the Associated Chambers of Commerce to take such steps as they consider best to impress upon all wool-growers at home and abroad—(*a*) The necessity of discontinuing the use of such deleterious materials in the marking of sheep ; (*b*) the great benefit that would thereby result to themselves in the increased value of the wool if guaranteed free from such matter ; and (*c*) the great saving to all manufacturers of all woollen goods."

WHEAT CONTROL: 1921-22 CROP FUTURES.

REGULATIONS under the Board of Trade Act, 1919, to regulate the disposal of the wheat crop for the coming season were gazetted on 29th September. It is provided that, except under the terms of a permit issued by the Wheat Controller, no person may purchase, sell, or take part in the making or fulfilling of any agreement to purchase or sell, any portion of the New Zealand wheat harvest for the 1921–22 season. This provision includes any mode of acquisition by agreement, or an option or right of purchase, but does not debar acquisition by way of security. Any agreement for purchase of wheat, in fulfilment of which 1921–22 produce might be delivered, comes within the scope of the regulations. The issue and revocation of permits is entirely in the hands of the Controller, who may impose such terms and conditions as he thinks fit, a holder being allowed to make only such dealings in wheat as are authorized in his permit. In the enforcement of these regulations the Controller may require any person to give him any information relating to the sale or purchase of wheat, and may examine any books or documents in this connection.

IMPORTATION OF GRASS-SEED FROM AUSTRALIA.

REGULATIONS under the Stock Act, gazetted and becoming operative on 22nd September, prohibit the importation into New Zealand of any grass-seed grown in the State of Queensland or in that part of the State of New South Wales constituting the tick-infestation quarantine area. Seed grown in portions of the latter State outside the quarantine area may be imported, however, provided it has, prior to shipment, been subjected to fumigation with cyanide for six hours, and is accompanied by a certificate to this effect from an officer of the Department of Agriculture of New South Wales. The regulations are precautionary against the introduction of cattle-tick disease from the States named through the medium of grass-seed, paspalum-seed in particular.

Land for Discharged Soldiers.—During the present month the following lands will be made available for selection by discharged soldiers : In Auckland Land District, fifteen sections known as the Hikuai Settlement, in areas ranging from 76 acres to 256 acres. The land is suitable for dairying and fattening. In Hawke's Bay Land District, ten sections in the Glencoe Settlement, of a total area of 477 acres, in areas ranging from 30 acres to 99 acres. The sections are nine miles from Gisborne, and are suitable for dairying. There are also a few scattered sections in North Auckland District, and two sections in Wellington District, as mentioned in last month's *Journal*.